भारतीय मानक

अग्नि शमन पम्पों का संस्थापन एवं रख-रखाव — रीति संहिता

Indian Standard

INSTALLATION AND MAINTENANCE OF FIRE FIGHTING PUMPS — CODE OF PRACTICE

ICS 13.220.10

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Fire Fighting Sectional Committee had been approved by the Civil Engineering Division Council.

All buildings depending upon the occupancy use and height are protected by fixed fire fighting installations as per the provisions laid down in SP 7 (Part 4). The fixed fire fighting installations are provided in multistoreyed building of height 15 metres or above and also other categories of buildings of lesser height but with special risks/basement, etc. Similarly, all factories/manufacturing industries also go for installation of fixed fire fighting system for protection of the property and life. The system may be in the form of wet riser, external hydrant or in the form of sprinkler/emulsifiers, etc, or all of them. The most important component in such a system is the fire pump. A carefully chosen fire pump of appropriate capacity and installed properly will form the back bone of such system. Even after installation, it is absolutely essential that the fire pumps are properly maintained and regularly tested so that they are in serviceable condition and come into operation instantly at the time of exergencies.

The requirements in regard to the installation and maintenance of internal or external fire hydrants are covered in separate Indian Standards (*see* IS 3844 and IS 13039).

The composition of the Committee responsible for formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirment of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

INSTALLATION AND MAINTENANCE OF FIRE FIGHTING PUMPS — CODE OF PRACTICE

1 SCOPE

This standard lays down the requirements of installation and maintenance of fire fighting pumps.

2 REFERENCES

The standards listed below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
1710 : 1989	Specification for vertical turbine pumps for clear, cold, fresh water (*second revision*)
2974 (Part 3) : 1992	Code of practice for design and construction of machine foundations: Part 3 Foundations for rotary type machines (medium and high frequency) (*second revision*)
2974 (Part 4) : 1979	Code of practice for design and construction of machine foundations: Part 4 Foundations for rotary type machines of low frequency (*first revision*)
3844 : 1984	Code of practice for installation and maintenance of internal fire hydrants and hose reel on premises
5120 : 1977	Technical requirements for rotodynamic special purpose pumps (*first revision*)
6070 : 1983	Code of practice for selection, operation and maintenance of trailer fire pumps, portable pumps, water tenders and motor fire engines (*first revision*)
9137 : 1978	Code for acceptance test for centrifugal, mixed flow and axial pumps — Class C
13039 : 1991	External hydrant systems — Provision and maintenance — Code of practice
SP 7 (Part 4) : 1983	National building code of India: Part 4 Fire protection (*first revision*)

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Static Water Tank

Underground or surface water tank, constructed to store water for fire fighting purpose.

3.2 Terrace Tank

A concrete/masonry/plastic/steel tank constructed or erected on terrace of building for fire fighting purpose.

3.3 Priming Tank

A small tank erected inside/over the pump house and above the fire fighting pumps to keep the pump casing and suction of the fire pump permanently flooded. This is required in case of negative suction.

3.4 Foot Valve-cum-Strainer

3.4.1 A valve fixed in the suction strainer of the fire pump which opens only inwards to allow in flow of water into the pump suction and fire pump when the pump is actuated automatically/manually, This is required in case of Negative suction.

3.4.2 In a positive (flooded) suction, a strainer placed in the suction line between the fire tank and fire pump to arrest any dirt/obstruction being fed into the pump suction.

3.5 Jockey Pump

A pump of small capacity which is set to come into operation automatically with drop in static pressure in the system and to automatically stop when the pre-set pressure is reached again.

3.6 Terrace Pump

An electrically driven pump, located on the terrace connected to a terrace tank with gate valve on suction side and to the internal hydrant system with non-return valve on delivery side.

3.7 Fire Pump

An electric/diesel pump installed at static water tank to charge the wet riser systems/sprinkler system, etc.

3.8 Stand-by Pump

A pump of same capacity as fire pump, driven by a diesel engine or connected to any other alternate source of electric supply.

3.9 Pump Panel

Panel comprising starting, stopping and indicating devices of fire pumps.

3.10 Pressure Switch

A switch connected on delivery line of fire pump, or in the body of hydro-pneumatic tank at pre-set pressure level so designed to automatically start the fire pump or jockey pump, as the case may be, when the pressure in the system falls below the pre-set level.

3.11 Circulation Relief Valve

The circulation relief valve put in below the shut off pressure to provide circulation and thereby relieve the extra pressure in the pump.

4 FIRE PUMPS AND PUMP HOUSE

4.1 The pump house should be located preferably outside the building with a minimum clearance of 6 m from adjoining buildings. The pump house should have adequate natural ventilation with windows, fitted with expanded metal for protection. In order to facilitate proper installation and maintenance of fire fighting pumps, there should be provision of mild steel girder of appropriate x-section at suitable height in pump house for fixing chain pulley block.

4.2 If the pump house has a diesel pump, the exhaust pipe of the diesel engine should be extended to outside the pump house and exhaust discharged at an appropriate height in the open air.

4.3 The floor of the pump house should be sloped to the farthest end to drain away any water leaking from glands, valves, etc.

4.4 The pump house should have normal lighting, and also emergency lighting facility, either from a second source or from the generator.

4.5 If the pump house is located inside the building, either on ground floor or in the basement, it should be separated from the rest portion with a wall having 2 h fire rating and fire check door at its entrance having 1 h fire rating. For pump house in basement, forced mechanical ventilation should be provided. Pump house in ground floor should be located on periphery of building with access directly from outside/open area. The pump house located in the basement should also have easy accessibility from outside preferably through ramp.

5 ARRANGEMENT OF PUMPS

5.1 The layout plans of pumps installed and fire water lines should be displayed. The pump house should be of adequate dimension to house all the pumps with suction, delivery pipes, fittings and starter control panel, air vessel, etc, with adequate circulation area. Adequate head room clearance all around the pump for maintenance shall be made available. A minimum clearance of 1 m at front and back and 0.75 m on sides and between pumps should be provided for all major pumps exceeding 2 280 l/min capacity. For smaller pumps, including jockey pumps, the clearance required should be 0.75 m at front and back and 0.60 m at sides and between pumps. The head room clearance for all pump houses should be minimum 2.75 m.

5.2 The pump control panel which should also be housed in the pump room but easily accessible, should be of adequate dimension to incorporate tripple pool and neutral (TPN) switch and high rupture capacity (HRC) switch both of adequate capacity, selector switch ammeter, voltmeter and phase indicating lights, single phase preventer, start and stop push buttons, auto-manual switch, auxiliary contractors for interlocking/sequence of operations and all necessary gauges, fittings required to complete the system (the busbar should be of copper of appropriate thickness). The panel should be floor mounted with proper grouting with the floor and be compartmentalized. The gauge thickness of panel should be 1.8 mm.

5.3 Where diesel pump is provided, it should have a separate panel, also located in the same pump room or adjoining separate room. The panel should have its separate battery, with battery charging device, and auto-manual changeover arrangement. It should incorporate an interlocking device with the main pump panel so that both the electric pump and the diesel pump do not operate simultaneously. Adequate precaution should be taken to avoid spillage of diesel to avoid any fire exergency.

5.4 Air vessel of adequate capacity should be installed in the pump house, with pressure switches incorporated on the delivery line. There should be two pressure switches—one with upper and lower limit for jockey pump and another one with only for lower pressure limit for the main pump. Stopping of main pumps should be only by manual push button which should be prominently indicated on the pump panel.

5.5 Similar lower pressure limit switch should also be incorporated in the diesel pump to make the start automatically at pre-set drop in pressure.

6 INSTALLATION OF FIRE PUMPS

6.1 The capacity of the fire pump should be carefully chosen to meet the maximum requirement for the risk

to be protected. The fire pumps have been divided into the following capacities:

a) 450 l/min,
b) 900 l/min,
c) 2 280 l/min,
d) 2 850 l/min, and
e) 4 500 l/min and for special risks 6 700 l/min.

Of the above, (a) and (b) are basically the pumps to be installed on the terrace to feed the Down Comer System. The other pumps are to be housed in the pump house. The pump house may be below the level of the water tank or constructed above the water tank depending upon the engineering conveniences. For fire fighting purpose, a pump house having the pumps below the water tank is always desirable, as this eliminates the necessity to have negative suction incorporating priming tank, foot-valve and other extra valves, etc. All pumps are required to be start on 'Auto', when there is a drop of pressure in the mains. These are required to be pre-set on predetermined pressure suitable to particular risk.

6.2 If the pump is electric driven, the capacity of the pump *vis-à-vis* its revolutions per minute must match with the electric motor being chosen for the same job. Electric motors required to feed the pump up to 2 280 l/min are usually running at 2 900 rev/min and the pumps required to match the motors must also run at the same revolutions per minute. These pumps are known as Single Stage Pumps and the suction is at the end of the pump so that these are called End Suction Pumps. Small capacity pumps/jockey pumps are also avalaible/required to be used in multi-stage design. The speeds of these pumps are suitable for 2 pole motor or 4 pole motor.

6.3 The fire fighting pumps are almost invariably centrifugal type excepting in some typical cases where vertical turbine or submersible pumps are installed. After the capacity of the pump and motor has been carefully chosen, to match each other perfectly, installation of the pumps in the pump house should be done with utmost care. As has been said above, the pump house shall have adequate spaces to keep enough circulation area within the pump house for the pump operator in times of emergency or maintenance. The pump and the motors are always cases connected together by connecting couplers and they are mounted on a common baseplate which is supplied by the pump manufacturers along with the pump. The baseplate shall be of sufficient length and width to house the pump and the motor comfortably.

6.4 In the first stage of the installation, pumps are to be mounted on a concrete foundation having minimum grade of reinforced concrete as M15. The foundation shall be of adequate thickness and dimension depending upon the type of the pump which will be installed. The thickness of the foundation shall be 50 mm minimum for small pumps up to 900 l/min capacity, 75 mm for pumps up to 2 280 l/min capacity and 100 mm for bigger pumps up to 4 500 l/min. For extra ordinary big pumps, the thickness may go up to 150 mm. The size of the foundation shall cover the full length and width of the pump and atleast 150 mm on the front and back of the pump and 75 mm on the sides as clearance. The foundation shall be designed as per IS 2974 (Part 3) and IS 2974 (Part 4).

6.5 It is recommended to provide a jockey pump to take care of system losses. The capacity of the jockey pump shall neither be less than 3 percent (with a minimum of 180 l/min) nor more than 10 percent of the installed pumping capacity.

6.6 Each pump shall be provided with a pressure gauge on the delivery side between the pump and the non-return valve and a manufacturer's plate indicating the delivery head, capacity and the number of revolutions per minute.

6.7 Pumps (other than Jockey pumps) should be able to develop head of greater than 65 percent of rated head at capacity of 150 percent of rated capacity. The rated head for vertical turbine pumps will be rated bowl head. The shut off head of pumps (other than jockey) should not exceed 120 percent of rated head for horizontal pumps and 140 percent of rated bowl head of vertical turbine pumps.

6.8 Each fire service pump shall be provided with an independent suction pipe without any sluice or cut-off valves therein, unless the pump is situated below the level of the water supply in which case sluice or cut-off valves is essential. Where the Net Positive Suction Head (NPSH) available at site is less than 0.5 m in excess of the actual value required at 150 percent of the duty point as per the manufacturer's curves or where the water supply has fibrous or equally objectionable matter in suspension or mud and/or sand liable to cause deposition in the installation, suction pipe(s) shall be installed in a jackwell (suction tank), fed through a pipe/pipes of appropriate dia from the main water supply. At the supply end of the major tank, where the main supply source is at a distance exceeding 20 m, a sluice or gate valve shall be provided. From fire water storage reservoir two separate connections are taken to suction header (from each compartment of fire water storage.)

6.9 The diameter of the suction pipe shall be such that the rate of flow of water through it does not exceed 1.5 m/s when the pump is delivering at its rated discharge. If, however, the pump is situated below the level of its water supply, the diameter of the suction pipe/header shall be based upon a rate of flow of 2 m/s.

6.10 When the pump is above the level of its water supply, there shall be a foot valve and a 'priming' arrangement, the latter consisting of a tank (having a capacity atleast three times that of the suction pipe including the pump casing from the pump to the foot valve), connected to the delivery side of the pump by a metal pipe having a minimum internal diameter of 100 mm in the case of centrifugal pumps with a stop valve and a non-return valve therein of the same size. A dependable independent filling arrangement and a level indicator shall be provided for the priming tank. The provision of a vacuum gauge for the suction pipe is recommended. Where circumstances permit, centrifugal pumps shall be fixed preferably below the level of the water supply. If the pump is automatic in action, it shall necessarily be so fixed.

6.11 However, for light and ordinary hazard occupancies if the priming arrangements are such as to ensure that the suction pipe shall be automatically maintained full of water notwithstanding a serious leakage therefrom (the pump being automatically brought into action to replenish the priming tank should the latter be drawn upon at a greater rate than the rate at which it is fed from any other source), positive suction may not be insisted. In such cases, the capacity of the priming tank need not exceed 450 l and the diameter of the priming pipe need not exceed 50 mm. Each pump shall be provided with an automatic by-pass connection and relief valve set below the shut off pressure. It shall provide circulation of sufficient water to prevent the pump from over heating when operating with closed delivery and no discharge. The circulation relief valve should discharge approximately 3-5 percent of the pump rating.

Test Line — Each pump shall be provided with test line and shut off valve for individual testing of pumps without discharging the system.

6.12 Pumps shall not be installed in the open. The pump room shall be so located as to be both easily accessible and where any falling masonry and the like from other buildings occasioned by fire or other cause, cannot damage the pump room. Normally, pump rooms shall be located 6 m away from all surrounding buildings and overhead structures. Where this is not feasible, they may be attached to a building provided a perfect seperation wall having 4 h fire rating is constructed between the pump room and the attached building, the roof of the pump room is of RCC construction atleast 100 mm thick and access to the pump room is from the outside. The pump rooms shall normally have brick/concrete walls and non-combustible roof with adequate lighting, ventilation and drainage arrangements.

6.13 The sub-station(s) and/or D.G. House(s) supplying power to the fire pump(s) shall be of incombustible construction and shall be located atleast 6 m away from all surrounding buildings. Where this is not feasible, all door and window openings of the surrounding buildings within 6 m of the sub-station(s) and/or D.G. House(s) shall be protected by single fireproof doors and 6 mm thick wired glasses in steel framework respectively. Likewise, roof eaves, if any of the surrounding buildings falling within 6 m of the sub-station(s) and/or D.G. House(s), shall be cut and wall raised as a parapet. The above provisions shall also apply when the sub-station(s) and D.G. House(s) are within 6 m of each other.

Where the sub-station(s) and D.G. House(s) are attached to buildings, a four-hour rated wall shall be constructed to segregate the sub-station(s) and D.G. House(s). This shall be of RCC construction atleast 200 mm thick or of masonry construction at least 230 mm thick.

6.14 Transformer cubicles inside the sub-stations shall be separated from H.T. and L.T. cubicles and from each other by walls of brick/stone/concrete blocks or 355 mm thickness or of RCC of 200 mm thickness with door openings, if any, therein being protected by single fireproof doors having 2-hour fire resistance. The sub-station(s) and/or D.G. House(s) shall also be seperated from each other as above. Transformers installed outdoors, which are supplying power to fire pump(s) shall also be located atleast 6 m away from all surrounding buildings [including sub-station(s) and/or D.G. House(s)]. Where this is not feasible, all door and window openings of the building(s) [including sub-station(s) and/or D.G. House(s) within 6 m of the transformers] shall be protected by single fireproof doors and 6 mm thick wired glasses in steel framework respectively. Likewise, roof eaves of the building(s) falling within 6 m of the transformers shall be cut and wall raised as a parapet. Blast walls of bricks/stone/concrete blocks of 355 mm thickness or of RCC of 200 mm thickness shall be constructed between transformers and these walls shall be extended horizontally 600 mm beyond the extremities of the transformers and vertically 600 mm above the highest point of the transformers.

6.15 The electric supply to the pump set(s) shall be entirely independent of all other equipment in the premises, that is, even when the power through-out the entire premises is switched off, the supply of the pump shall continue to be available uninterrupted. This can be achieved by taking the connection for the pump(s) from the incoming side of the main L.T. breaker. However, in cases where two or more transformers and/or sources of supply are connected to a common busbar or where there is provision of a

bus coupler between the busbar sections, the connection may be taken through the busbars.

6.16 Fire Extinguisher

The pump room should be protected by appropriate type of extinguishers either CO_2 or DCP. If the pumps are in basement, it is desirable to have the pumps protected by automatic sprinkler system.

7 MAINTENANCE

7.1 The fire pump shall be maintained regularly and properly. Therefore, it is absolutely essential that someone responsible person should be given the charge of ensuring that the fire pumps are properly maintained.

7.2 The following maintenance schedule shall be maintained.

7.2.1 After the fire fighting pump has been commissioned and the system has been taken over by testing it according to the performance parameters laid down for the fire pump, this should be recorded in a maintenance register, to be kept in the pump house. The initial test should show the following:

a) Flow obtained at 7 kgf/cm^2,

b) Flow obtained at 4.5 kgf/cm^2 (65 percent of 7 kg), and

c) Pressure gauge recording at 120 percent of 7 kg.

7.3 After this initial take over of the pump, the following shall be the routine maintenance schedule.

7.3.1 *Daily Check*

a) *Testing of the Jockey Pump*

Test the jockey pump daily by opening the delivery valve/hose reel very slightly to allow the pressure to drop up to the pre-set level. Note the timing taken by the jockey pump to restore the pressure automatically by cut off switch.

b) *Main Pump*

The main pump shall be tested daily atleast for 5 min. Release the system pressure by opening the hydrant valve partially. The jockey pump will come in operation. Open the valve fully when further drop in pressure which will allow the main pump to start automatically. Close the delivery outlet and allow the pump to run for 5 min every morning.

c) Check the pump glands, packings, etc, and replace the damaged gland for packing whenever found damaged or worn out.

7.3.2 *Weekly Check*

a) Check bearings grease cut once a week and lubricate as needed.

b) Cleaning of starter contacts every week.

c) Check the insulation resistance of pump motor circuit every week.

d) Check the engine fuel oil tank and ensure that this is of appropriate grade and quality.

e) Check the quantity of fuel oil in the tank. This should be sufficient for 4 h running without replenishment. Check the sludge and sediment trap as provided in the auxiliary equipment list. Check the inspection and cleaning hole, check the battery/batteries required for starting of the engine and ensure that these are in satisfactory condition. Also check the battery charging arrangement by trickler charger.

For every cold areas, space heating is necessary to keep the engine in reasonably warm condition for immediate starting. If so, ensure that the room heating arrangement is working satisfactory.

f) Starting diesel engine once every week and run it for 10 min. The starting should be tested by switching off the current and allowing system pressure to drop up to the pre-set level for diesel engine. Interlock arrangement with power supply should be restored.

g) Check alignment of pump motors, nuts, bolts, couplings, coupling guard, etc, once every week after the pump has run for continuous 15 min.

7.3.3 Inspection shall be carried out as per the requirements given in IS 1710, IS 5120, IS 6070 and IS 9137.

7.4 Manufacturers shall provide a list of fast moving spares.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Fire Fighting Sectional Committee, CED 22

Organization	*Representative(s)*
Ministry of Home Affairs, New Delhi	SHRI OM PRAKASH (***Chairman***) SHRI D. K. SHAMI (*Alternate*)
Airport Authority of India, New Delhi	SHRI L. C. GUPTA SHRI H. S. RAWAT (*Alternate*)
Andhra Pradesh Fire Services, Hyderabad	SHRI SWARANJIT SEN
Bhabha Atomic Research Centre, Mumbai	CHIEF FIRE OFFICER
Bombay Fire Brigade, Mumbai	CHIEF FIRE OFFICER SHRI G. S. SAWANT (*Alternate*)
Central Building Research Institute, Roorkee	DR T. P. SHARMA DR A. K. GUPTA (*Alternate*)
Central Industrial Security Force, New Delhi	DEPUTY INSPECTOR GENERAL (FIRE) SHRI S. L. NAGARKAR (*Alternate*)
Central Public Works Department, New Delhi	CHIEF ENGINEER (E)
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Defence Research and Development Organization, Delhi	DIRECTOR (FIRE SAFETY) DEPUTY DIRECTOR (FIRE SAFETY) (*Alternate*)
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Loss Prevention Association of India, Mumbai	MANAGING DIRECTOR SHRI D. K. SARKAR (*Alternate*)
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MECON Limited, Ranchi	SHRI R. N. CHACHRA SHRI SUNIL DAS (*Alternate*)
Newage Industries, Mumbai	SHRI B. J. SHAH SHRI A. M. SHAH (*Alternate*)
Northern Railway, New Delhi	SHRI I. M. MANSOORI
Oil and Natural Gas Commission, Dehra Dun	SHRI R. P. SAXENA SHRI NEERAJ SHARMA (*Alternate*)
Oil Industry Safety Directorate, New Delhi	JOINT DIRECTOR (PROCESS)
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Safex Fire Services Limited, Mumbai	SHRI JITENDRA SHAH SHRI SANDIP SHAH (*Alternate*)

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Organization	*Representative(s)*
State Bank of India, Mumbai	SHRI J. S. GAHLAUT
State Fire Training Centre, Mumbai	DR NAVINCHANDRA JAIN
Steel Authority of India, Rourkela	SHRI B. N. DAS SHRI B. P. DAS (*Alternate*)
Steel Authority of India, Bokaro	SHRI A. RAUTELA SHRI C. P. SINGH (*Alternate*)
Steelage Industries Limited, New Delhi	CHIEF EXECUTIVE SHRI V. KAMALANATHA (*Alternate*)
Surex Production and Sales (P) Limited, Kolkata	SHRI TARIT SUR SHRI D. NEOGI (*Alternate*)
Tariff Advisory Committee, Mumbai	SHRI T. R. A. KRISHNAN
Tariff Advisory Committee, Chennai	SHRI A MUKHERJEE SHRI H. C. MAHESH KUMAR (*Alternate*)
Vijay Fire Protection Systems Pvt Limited, Mumbai	SHRI HARISH SALOT
West Bengal Fire Service, Kolkata	SHRI B. PATHAK
In personal capacity (*33/2965-A, Vennala High School, Vennala, Cochin*)	SHRI G. B. MENON
In personal capacity (*29/25, Rajendra Nagar, New Delhi*)	SHRI S. K. DHERI
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Member Secretary
SHRI S. CHATURVEDI
Joint Director (Civ Engg), BIS

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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