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Technical Code for Water Mist Fire Extinguishing System

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Issued by: Ministry of Housing and Urban-Rural Development of the People's Republic of China;

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Announcement of the Ministry of Housing and Urban-Rural Development of the People's Republic of China

No. 54

Announcement of the Ministry of Housing and Urban-Rural Development on Issuing the National Standard, Technical Code for Water Mist Fire Extinguishing System

We hereby approve GB 50898-2013, *Technical Code for Water Mist Fire Extinguishing System*, to be a national standard, which will be implemented from December 1, 2013. Paragraphs 3.3.10, 3.3.13, 3.4.9 (1, 2, 3), 3.5.1 and 3.5.10 are compulsory provisions which shall be executed to the letter.

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Ministry of Housing and Urban-Rural Development
of the People's Republic of China

June 8, 2013

Foreword

This Standard was drafted by Tianjin Fire Research Institute of the Ministry of Public Security jointly with other organizations concerned, in accordance with the requirements of the former Ministry of Construction, the *Notice on Issuing the Development and Amendment Plan of Engineering Construction Standards in 2007*.

During the drafting of this standard, the drafting set followed the national policies concerning capital construction and the fire protection working policy “prevention first; combination of fire extinguishing and prevention”, solicited opinions from all sides with in regard to design, construction, manufacture, research, education and fire supervision based on the summary of research findings, design, construction, acceptance and use status as well as the engineering application experiences in regard to water mist fire extinguishing in China, and mean while studied, digested and absorbed relevant domestic and foreign standards and the finally finalized the standard by examination.

This Standard is divided into 6 chapters and 7 annexes, mainly including General Provisions, Terms and Symbols, Design, Construction, Acceptance, and Maintenance and Management and so on.

The paragraphs boldfaced in this Standard are compulsory provisions, which shall be executed to the letter.

The Ministry of Housing and Urban-Rural Development is responsible for the administration of this Standard and the interpretation of the compulsory provisions; the Ministry of Public Security is responsible for the routine administration work; and Tianjin Fire Research Institute of the Ministry of Public Security is responsible for the specific interpretation of the compulsory provisions. Each organization is advised to sum up experiences and collect data in the implementation of this Standard and post timely their opinions and relevant data to Tianjin Fire Research Institute of the Ministry of Public Security (address: No. 110 Weijinnan Road, Nankai District, Tianjin; Zip code: 300381) as the references for the amendments in the future.

The main drafting organization, participating drafting organizations, main drafters and main examiners of this Standard:

Main drafting organization:

Tianjin Fire Research Institute of the Ministry of Public Security

Participating drafting organizations:

Institute of Engineering Design and Research of the General Reserve Department of PLA
Beijing Public Security Fire Force
Tianjing Public Security Fire Force
Shanghai Public Security Fire Force
Guangdong Guangzhou Public Security Fire Detachment

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Technical Code for Water Mist Fire Extinguishing System

1 General Provisions

1.0.1 This Standard was drafted in order to design the water mist fire extinguishing system in an appropriate way, ensure its construction quality, standardize its acceptance, maintenance and management, reduce fire hazard and protect personal and property security.

1.0.2 This Standard applies to the design, construction, acceptance and maintenance and management of water mist fire extinguishing system provided for construction projects.

1.0.3 The water mist fire extinguishing system applies to the extinguishing of combustible solid surface fire, combustible liquid fire and live equipment fire in a relatively enclosed space.

The water mist fire extinguishing system does not apply to the extinguishing of the following fires:

1 combustible sold deep fire;

2 fire of active metals and other compounds which are capable of drastic action with water and generate lots of hazardous substance; and

3 combustible gas fire.

1.0.4 The design of the water mist fire extinguishing system shall be based on the functions and fire characteristics of the protection objects; effective technical measures shall be taken in order to make it safe and reliable, advanced and economic.

1.0.5 The design, construction, acceptance and maintenance and management of the water mist fire extinguishing system shall be as specified in relevant national standards.

2.1.10 Response time

the time FROM the system giving a fire extinguishing command with the automatic fire alarm system TO the water mist spraying from the nozzle at the most adverse point

2.2 Symbols

2.2.1 Flow rate

q – the design flow rate of the nozzle;

q_i – the calculated design flow rate of nozzle;

Q_s – the design flow rate of the system;

Q – the flow rate of the pipe;

R_e – the Reynolds number;

f – the friction coefficient;

K – the flow coefficient of the nozzle;

ρ – the fluid density;

μ – the dynamic viscosity;

Δ – the relative roughness of the pipe;

ε – the roughness of the pipe; and

C – the Hazen-Williams coefficient.

2.2.2 Pressure

P – the design working pressure of the nozzle;

P_c – the elevation difference between the nozzle at the most adverse point and the lowest level of the water storage container;

P_f – the water head loss of the pipe;

P_s – the working pressure of the nozzle at the most adverse point; and

P_t – the design water supply pressure of the system.

2.2.3 Geometrical characteristics etc.

d – the inner diameter of the pipe;

L – the calculated length of the pipe;

3 Design

3.1 General Provisions

3.1.1 The products and components for the system design shall be as specified in the current national standard, GB/T 26785, *General specification for water mist fire extinguishing system and components*.

3.1.2 The type and design of the system shall be determined based on the analysis of the factors including the fire risk of the protection objects and their fire characteristics, design fire protection objectives, characteristics of the protection objects, environmental conditions and spray characteristics of the spacing.

3.1.3 The type of the system shall meet the following provisions:

1 it is preferable to select the open-type system with the total flooding application method for hydraulic pressure stations, switching rooms, cable tunnels, cable interlayers, electronic information system rooms, cultural relic rooms and dense cabinet storage libraries, reference rooms and archival repositories;

2 it is preferable to select the open-type system with the local application method for oil immersed transformer rooms, turbine rooms, diesel generator rooms, lubricating oil stations and fuel oil boiler rooms, and cooking appliances as well as their exhaust hoods and exhaust duct in a kitchen; and

3 the close-type system can be selected for non-dense cabinet storage libraries, reference rooms and archive repositories.

3.1.4 It is preferable to use the pump supply system for the system; the self-contained system shall not be used for the close-type system.

3.1.5 When the total flooding application method is used for the open-type system, the opening in the enclosure which affects the effectiveness of fire extinguishing is preferably closed in linkage during the operation of the system. When the opening in the enclosure is incapable of being closed automatically at the time of the activation of the system, it is preferable to add a nozzle above the opening position.

3.1.6 When the local application method is used for the open-type system, the gas velocity around the protection objects is preferably not more than 3 m/s. Take wind protection measures, if necessary.

3.2 Nozzle Selection and Layout

3.2.1 The nozzle selection shall meet the following provisions:

1 for the place where it is liable to block the orifice of the nozzles, select the nozzles which are equipped with corresponding protective measures and will not affect the spray effects of water mist;

1 a pressure gauge shall be provided in front of the water testing valve;

2 the flow coefficient of the outlet of the water testing valve is equivalent to the flow coefficient of one nozzle; and

3 the size of the interface of the water testing valve shall be consistent with the pipe at the end of the pipe network; the discharge of testing water does no harm to the personnel, equipment or others.

3.3.6 For the open-type system with the total flooding method, its pipe network shall be arranged evenly.

3.3.7 The lowest point of the system pipe network shall be provided with a sluice valve.

3.3.8 For the oil immersed transformer, it is not appropriate for the system pipe to stretch over the top of the transformer and shall not affect the normal operation of the equipment.

3.3.9 The system pipe shall be fixed to the construction components with anti-oscillation metallic supports and hangers. The supports and hangers shall be able to withstand the weight and impact of the pipe when it is filled with water; the spacing shall not be more than that specified in Table 3.3.9.

The supports and hangers shall be treated for corrosion resistance and prevention from electrochemical corrosion with the pipe.

Table 3.3.9 – Spacing of supports and hangers of the system

Pipe outer diameter (mm)	≤ 16	20	24	28	32	40	48	60	≥ 76
Maximum spacing (m)	1.5	1.8	2.0	2.2	2.5	2.8	2.8	3.2	3.8

3.3.10 Austenitic stainless steel pipe manufactured by the cold-drawing process or other metallic pipes with equivalent corrosion resistant and pressure resistant properties shall be used as the system pipe. The materials and properties of the pipe shall be as specified in the current national standards, GB/T 14976, *Seamless stainless steel pipes for fluid transport*, and GB/T 12771, *Welded stainless steel pipes for liquid delivery*.

When the maximum working pressure of the system is not less than 3.50 MPa, use the seamless austenitic stainless steel tube of the designation 022Cr17Ni12Mo2 as specified in the current national standard GB/T 20878, *Stainless and heat-resisting steels – Designation and chemical composition*.

3.3.11 The material of the fastenings of the system pipe shall be the same as that of the pipe. It is preferable to use special purpose joint or flange connection for the system pipe; argon arc welding can also be used.

3.3.12 The nominal pressure of the system components, pipes and pipe fittings shall

shall meet the following provisions:

1 the volume of all partitions is preferably not more than 3 000 m^3 for the pump supply system and 260 m^3 for the self-contained system;

2 when the fire risks of all partitions are the same or similar, the design parameters of the systems can be determined in accordance with the parameters of the partition with the maximum volume;

3 when the fire risks of all partitions are significantly different, the design parameters of the systems shall be determined in accordance with the parameters of their own partition; and

4 when the design parameters are inconsistent with those specified in Table 3.4.4 of this Standard, they shall be determined by the simulated fire test.

3.4.6 When the open-type system with the local application method is used to protect a site with combustible liquid fire risks, the design parameters of the system shall be determined in accordance with the test data obtained from the certification test conducted by a state-authorized certification body in accordance with GB/T 26785, *General specification for water mist fire extinguishing system and components*, during the product certification test; the design parameters shall not exceed the conditions defined for the test.

3.4.7 For the open-type system with the local application method, its enclosure shall be determined in accordance with the following provisions:

1 for a protection object with regular shape, it shall be the outer surface area of the protection object;

2 for a protection object with irregular shape, it shall be the outer surface area of the minimum regular shape containing the protection object; and

3 for a protection object which may have combustible liquid flowing fire or spraying fire, it shall also include the horizontal projection area of the area that the combustible liquid flowing fire or spraying fire may affect, in addition to the requirements in paragraphs 1 and 2 of this Section.

3.4.8 The design response time of the open-type system shall not be more than 30 s.

When the open-type system with the total flooding application method is equipped with self-contained systems and multiple self-contained systems within an enclosure, all self-contained systems can be activated simultaneously and their response time difference shall not be more than 2s.

3.4.9 The design continuous mist spray duration of the system shall meet the following provisions:

1 when it is used to protect electronic information system rooms, power distribution rooms and other electronic and electric equipment rooms, and libraries, reference rooms, archival repositories, cultural relic rooms, cable tunnels and cable interlayers and other sites, the design continuous mist spray time of the system shall not be less than 30 min;

2 when it is used to protect oil immersed transformer rooms, turbine rooms, diesel oil generator rooms, hydraulic stations, lubricating oil stations, fuel oil boiler rooms and other mechanical equipment rooms containing combustible liquids, the design continuous mist spray time of the system shall not be less than 20 min;

3 when it is used to extinguish the fire of the cooking appliances in a kitchen or its exhaust hood and exhaust duct, the design continuous mist spray time of the system shall not be less than 15 s and the design cooling time shall not be less than 15 min; and

4 for the self-contained system, the design continuous mist spray time of the system shall be determined in accordance with 2 times of the fire extinguishing time of the simulated fire test and is preferably not less than 10 min.

3.4.10 The simulated fire test for the determination of the design parameters of the system shall be conducted by a state-authorized body and shall be as specified in Annex A of this Standard. When the results of the simulated fire test are used in engineering applications, they shall meet the following provisions:

1 the design mist spray intensity of the system shall not be smaller than the mist spray intensity used in the test;

2 the minimum working pressure of the nozzles shall not be less than the working pressure of the nozzles at the most adverse point measured in the test;

3 the layout spacing and installation height of the nozzles shall not be more than the spacing and installation height of the nozzles in the test; and

4 the installation angle of the nozzles shall be consistent with the installation angle in the test.

II Hydraulic calculation

3.4.11 The water head loss of the system pipe shall be calculated in accordance with the following equation:

area is not lower than the value specified in Table 3.4.2 and Table 3.4.4 of this Standard or the spray intensity determined in the simulated fire test.

3.4.20 The design effective volume of the water storage tank or water storage container of the system shall be calculated in accordance with the following equation:

$$V = Q_s \cdot t \qquad (3.4.20)$$

where:

V – the design effective volume of the water storage tank or water storage container (L);

t – the design spray time of the system (min).

3.4.21 The replenishing flow rate of the water storage tank of the pump supply system shall not be less than the design flow rate.

3.5 Water Supply

3.5.1 The water quality for the system shall meet the technical requirements of the manufacturer as well as the following requirements:

1 the water quality for the pump supply system shall not be lower than that specified in the current national standard, GB 5749, *Standards for drinking water quality*;

2 the water quality for the self-contained system shall not be lower than that specified in the current national standard GB 17324, *Hygienic standard of bottled (barreled) purified water for drinking*; and

3 the water quality of the replenishing water source of the system shall be consistent with the water quality of the system.

3.5.2 The water supply device of the self-contained system consists of water storage container, gas storage container and pressure display device and other components; the water storage container and gas storage container shall be provided with safety valves.

For the water storage containers or gas storage containers in the same system, their specifications, filling volume and filling pressure shall be consistent.

The water storage container set and its layout shall be convenient for examination, testing, re-filling and maintenance; the distance from its operation surface to the wall or the distance between operation surfaces is preferably not less than 0.8 m.

3.5.3 For the water storage capacity and driving gas storage capacity of the self-contained system, the spare capacity shall be provided in accordance with the

3.5.6 The pump supply system of the close-type system shall be equipped with a stabilized pressure pump; the flow rate of the stabilized pressure pump shall not be more than the flow rate of the nozzle at the most adverse hydraulic point in the system and its working pressure shall meet the activating requirements of the working pump.

3.5.7 The pump or other water supply equipment shall meet the requirements of the system for flow rate and working pressure; its working status and its power supply status can be monitored in the duty room for fire protection.

3.5.8 The pump supply system shall be provided with one reliable automatic replenishing water source at least; the flow rate and pressure of the replenishing water source shall meet the design requirements of the system.

When the flow rate of the water source fails to meet the design requirements, the pump supply system shall be provided with a special purpose water storage tank, and its effective volume shall be as specified in paragraph 3.4.20 of this Standard.

3.5.9 The inlet of the water storage tank shall be provided with a filter; a filter shall be provided in front of the outlet or control valve; the installation position of the filters shall be convenient for maintenance, replacement and cleaning.

3.5.10 The filters shall meet the following provisions:

1 the material of the filters shall be stainless steel and copper alloy or other materials with corrosion resistance not lower than stainless steel or copper alloy; and

2 the mesh size of the filters shall not be more than 80% of the minimum orifice diameter of the nozzles.

3.5.11 The ambient temperature of the water supply equipment and pipe of the close-type system shall not be lower than 4°C and not higher than 70°C.

3.6 Control

3.6.1 The self-contained system shall have automatic, manual and mechanical emergency operation controls; its mechanical emergency operation is capable of direct manual activation of the system within the self-contained system.

The pump supply system shall be provided with automatic and manual controls.

3.6.2 The automatic control of the open-type system shall be capable of automatic activation after receiving two independent fire alarm signals.

The automatic control of the close-type system shall be capable of direct interlocking automatic activation with the actuating signal feedback device after the operation of the nozzles.

3.6.3 The manual activation device of the system shall be provided in the fire

4 Installation

4.1 General Provisions

4.1.1 The system construction can be divided into 4 sub projects including receiving inspection, system installation, system debugging and system acceptance and shall be as specified in Annex B of this Standard.

4.1.2 The construction site shall have corresponding construction organization plan, quality management system and construction quality inspection system, and shall accomplish the quality control of the whole construction process. The construction site quality management shall be filed and recorded in accordance with Annex C of this Standard.

4.1.3 The construction shall be performed in accordance with the engineering design documents examined and approved. The design changes shall be issued by the original designer.

4.1.4 Quality control shall be conducted for the construction process in accordance with the following provisions:

1 receiving inspection shall be conducted for the system components and materials in accordance with the provisions in 4.2 of this Standard, which shall be installed and used after they are qualified and signed by the supervising engineer;

2 quality control shall be conducted for each procedure in accordance with the construction organization plan; after each procedure, handover and approval shall be conducted between adjacent crafts and then the next procedure can only be started after the signature of the supervising engineer;

3 the supervising engineer invites the builder to perform inspection; and

4 before sealing the concealed work, the builder shall notify the departments concerned to perform acceptance and keep records.

4.1.5 The safety protection measures shall be taken during the installation process of the system.

4.1.6 The installation of the automatic fire alarm systems and other linkage control devices in linkage with the system shall be as specified in the current national standard GB 50166, *Code for installation and acceptance of fire alarm system*.

4.1.7 After the installation of the system, the builder shall conduct system commissioning. When the system requires the linkage with relevant automatic fire alarm systems and linkage control devices, a joint debugging shall be conducted.

2 the exposed non-mechanical processed surface protective coating shall be intact;

3 all exposed openings shall be plugged and sealed well; and

4 the nameplate shall be marked clearly, indelibly and in a correct direction.

Inspection quantity: complete inspection.

Inspection method: visual inspection and examination of the product manufacturing certificate and the documents required by the market access system.

4.2.6 The receiving inspection of the water mist nozzles shall meet the following provisions:

1 The marking of the nozzles shall be complete and clear, including trademarks, types, manufactures and manufacturing dates;

2 the quantity of the nozzles shall meet the design requirements;

3 the appearance of the nozzles shall be free from processing defects or mechanical damages; and

4 the thread sealing surface of the nozzles shall be free from scar, burr, missing thread or broken thread.

Inspection quantity: random inspection of 1% for the products of different types and specifications and not less than 5 pcs; if it is less than 5 pcs, then carry out complete inspection.

Inspection: visual inspection and examination of the manufacturing certificate of the nozzles and the documents required by the market access system.

4.2.7 The receiving inspection of the valve set shall meet the following provisions:

1 the marking of all valves shall be intact, including trademarks, types and specifications;

2 all valves and fittings shall be complete, which shall be free from processing defects or mechanical damages;

3 the conspicuous location of the control valve shall be marked indelibly with the water flow direction; and

4 the flap and operating mechanism of the control valve shall be flexible without jamming. It shall be clean without foreign objects inside of the valve body. The inlets and outlets of the valve set shall be sealed well.

Inspection quantity: complete inspection.

3 the pressure gauge on the cylinder set container shall face the operating surface and the installation height and direction shall be consistent.

Inspection quantity: complete inspection.

Inspection method: measurement and visual inspection.

4.3.4 The installation of the pump set shall meet the following provisions, in addition to the current national standards GB 50231, *General code for construction and acceptance of mechanical equipment installation engineering*, and GB 50275, *Code for construction and acceptance of fan, compressor and pump installation engineering:*

1 when the system is equipped with a plunge pump, fill lubricating oil after the installation of the pump set and examine the oil level; and

2 the reducing part of the water absorption pipe of the pump set shall be connected with a concentric reducer.

Inspection quantity: complete inspection.

Inspection method: visual inspection; activation of the high-pressure pump set for inspection.

4.3.5 The installation of the pump set control cabinet shall meet the following provisions:

1 the horizontal deviations of the control cabinet base shall not exceed ± 2 mm/m and corrosion resistance and waterproofing measures shall be taken;

2 the control cabinet and base shall be fixed with the bolts with a diameter not less than 12 mm, not less than 4 bolts for each cabinet; and

3 when the cable inlet and outlet are made, they shall not damage the protection degree of the control cabinet.

Inspection quantity: complete inspection.

Inspection method: visual inspection.

4.3.6 The installation of the pump set shall meet the following provisions in addition to the current national standard GB 50235, *Code for construction of industrial metallic piping engineering*:

1 the installation positions of observation instruments of the valve set and the operating valves shall be determined in accordance with the design requirements for the convenience of observation and operation. The open-close sign on the valve set shall be convenient for identification; the control valve shall be provided with a permanent sign indicating the enclosure controlled.

4 the casing pipes shall be used where the pipes penetrated the wall or slab. The length of the casing pipes penetrating the wall shall not be less than the thickness of the wall and the length of the casing pipes penetrating the slab shall be 50 mm above the floor. The clearance between the pipes and casing pipes shall be filled and sealed with fire resistant blocking materials. Take electrostatic eliminating measures when arranging the pipes on the site with explosion risks; and

5 the fixing of the pipes shall be as specified in 3.3.9 of this Standard.

Inspection quantity: complete inspection.

Inspection method: measurement and visual inspection.

4.3.8 The pipes shall be washed after installation and fixing and shall meet the following provisions:

1 before washing, take protective measures for the instruments of the system, carry out inspection for the supports and hangers of the pipes and take reinforcement measures if necessary;

2 the water quality for washing meets the requirements of the system;

3 the flow rate for washing shall not be lower than the design flow rate; and

4 after washing, the pipe washing records shall be kept in accordance with D.0.3 of this Standard.

Inspection quantity: complete inspection.

Inspection method: it is preferable to use the maximum design flow rate for the inspection by partition and by section along the water flow direction in the pipe network when extinguishing a fire and it is a pass if there is no impurity by examination with white cloth.

4.3.9 After the pipes are washed, the pressure test shall be carried out for the pipes and shall meet the following provisions:

1 the water quality of the test water shall be consistent with the wash water for the pipes;

2 the test pressure is 1.5 times of the working pressure of the system;

3 the testing point is preferably the lowest point of the system pipe network. The equipment, instruments, valves and accessories which are not allowed to be tested shall be isolated or installed after the test; and

4 after the test, the test records shall be kept in accordance with Table D.0.4 of this Standard.

1 the system and the fire alarm system or other devices and power supplies in linkage with the system shall be in the quasi-working status and the site safety conditions meet the debugging requirements;

2 the inspection equipment required for the system debugging shall be complete and the instruments required for the debugging shall be connected and fixed to the system after calibration; and

3 there shall be a debugging plan approved by the supervising engineer.

4.4.2 The system debugging shall include the commissioning and linkage tests of the pump sets, stabilized pressure valves and partition control valves; it shall be carried out in accordance with the procedures approved.

4.4.3 The debugging of the pump set shall meet the following provisions:

1 when the pump set is activated automatically or manually, the pump set shall be operated immediately;

Inspection quantity: complete inspection.

Inspection method: manual or automatic activation of the pump set.

2 when the pump set is activated with the standby power supply switching method or the standby pump switching method, the pump set shall be operated immediately.

Inspection quantity: complete inspection.

Inspection method: manual activation of the pump set.

3 when the diesel pump is used as the standby pump, the activation time of the diesel pump shall not be more than 5 s.

Inspection quantity: complete inspection.

Inspection method: manual activation of the diesel pump.

4 the no-load and load control debugging shall be carried out for the control cabinets. The control cabinets shall be capable of normal operation and display in accordance with the design functions.

Inspection quantity: complete inspection.

Inspection method: visual inspection by electrifying the instruments including voltmeter, amperemeter and megameter.

4.4.4 During the debugging of the stabilized pressure valve, the stabilized pressure valve can be activated immediately under the simulated design activation conditions;

2 during the simulated water mist spray test, open the release testing valve manually. When the simulated fire signal activation system is used, the pump set or cylinder set shall be capable of operating and giving corresponding operating signals and the operating signal feedback device of the system shall be capable of giving the feedback signal to activate the system in time.

Inspection quantity: complete inspection.

Inspection method: visual inspection.

3 the warning lamp at the entrance of corresponding sites shall be turned on.

Inspection quantity: complete inspection.

Inspection method: visual inspection.

4.4.8 The linkage test for the close-type system can be simulated by using the water testing valve to discharge water. After opening the water testing valve, the pump set shall be capable of activating and giving corresponding operating signals in time; the operating signal feedback device of the system shall be capable of giving the feedback signals to activate the system.

Inspection quantity: complete inspection.

Inspection method: visual inspection after opening the water testing valve to discharge water.

4.4.9 When the system needs to be in linkage with the automatic fire alarm system, the simulated fire signals can be used to carry out the test. Under the simulated fire signals, the fire alarm device shall be capable of giving alarm signals, the system shall operate, the relevant linkage control devices shall be capable of giving automatic turnoff commands and the relevant facilities supplying combustible gas or liquid which need to be closed during a fire shall be turned off in linkage.

Inspection quantity: complete inspection.

Inspection method: visual inspection by simulating fire signals.

4.4.10 After the debugging of the system, keep the debugging records in accordance with Table D.0.6 of this Standard, use compressed gas or nitrogen for purging and restore the system to a quasi-working status.

valves and others on the discharging pipes shall meet the design requirements; the service valves on the suction pipes and discharging pipes shall be locked at the normally open position and marked clearly;

Inspection quantity: complete inspection.

Inspection method: visual inspection based on the design data and product specifications.

2 the suction method of the pumps shall meet the design requirements;

Inspection quantity: complete inspection.

Inspection method: visual inspection.

3 the pressure and flow rate of the pumps shall meet the design requirements;

Inspection quantity: complete inspection.

Inspection method: visual inspection with the instruments such as pressure gauge and flow meter by activating the release testing valve on the pump discharging pipe automatically.

4 the pump set shall be capable of normal activation within the specified time under the main power supply;

Inspection quantity: complete inspection.

Inspection method: open the release testing valve on the pump discharging pipe and use the main power supply to feed the pump set; close the main power supply to check the switchover of the main and standby power supplies and use the instruments such as a stopwatch for visual inspection.

5 when the water pressure in the system pipe network decreases to the design minimum pressure, the stabilized pressure pump shall be capable of automatic activation;

Inspection quantity: complete inspection.

Inspection method: visual inspection with the pressure gauge.

6 the pump set shall be capable of automatic activation and manual activation;

Inspection quantity: complete inspection.

Inspection method: for the open-type system, use the simulated fire signals to activate the pump set to carry out automatic activation inspection. For the close-type system, open the end water testing valve to activate the pump set to carry out visual inspection. For the manual activation inspection, push the button of the pump control cabinet to carry out visual inspection.

2 the partition control valves of the open-type system shall be capable of operating reliably with the manual and automatic methods;

Inspection quantity: complete inspection.

Inspection method: visual inspection of the open-close feedbacks of the valves by activating the partition control valves manually and electrically.

3 the partition control valves of the close-type system shall be capable of operating reliably with the manual method;

Inspection quantity: complete inspection.

Inspection method: visual inspection after closing the partition control valves at the normally-open position manually.

4 the valves in front of and behind the partition control valves shall be at a normally-open position.

Inspection quantity: complete inspection.

Inspection method: visual inspection.

5.0.7 The acceptance of the pipe network shall meet the following provisions:

1 the materials, specifications, diameters, connection types, installation positions and anti-freezing measures of the pipes shall meet the design requirements and 4.3.7 of this Standard.

5.0.8 the acceptance of the nozzles shall meet the following provisions:

1 the quantities, specifications and types of the nozzles and the nominal operating temperature of the close-type nozzles shall meet the design requirements;

Inspection quantity: complete inspection.

Inspection method: visual inspection.

2 the installation positions, installation heights and spacing of the nozzles and their distances to the walls, beams and other obstacles shall meet the design requirements and 4.3.11 of this Standard, with the distance deviations not more than ± 15 mm;

Inspection quantity: complete inspection.

Inspection method: measurement based on the drawings.

3 the reserve level of the nozzles of different types shall not be less than 1% of their actual quantity installed and not less than 5 for each kind of spare nozzle.

6 Maintenance and Management

6.0.1 The user shall establish a system of maintenance and management for the system and follow the maintenance system and operating procedures to ensure the system remains in a normal operating status.

6.0.2 The maintenance and management of the system shall be carried out by the personnel who have been trained. The personnel for maintenance and management shall be familiar with the working principles of the system and the methods and requirements of operation and management.

6.0.3 The maintenance and management of the system is preferably carried out in accordance with Table G.0.1 of this Standard; the records of maintenance and management of the system shall be kept in accordance with Table G.0.2.

6.0.4 When the system needs to be maintained in case of any fault, it shall be carried out after it has been approved by the fire protection responsible person and corresponding protective measures have been taken.

6.0.5 When the use or geometrical characteristics of a building is changed or the characteristics of the combustible substances may affect the fire extinguishing effectiveness of the system, the system shall be verified and designed once again.

6.0.6 Daily inspection, monthly inspection, quarterly inspection and annual inspection shall be carried out for the system in accordance with this Standard; the problems spotted in the inspections shall be handled in time as specified.

6.0.7 The following items of the system shall be examined once every day:

1 examine whether the appearance and open-close status of all kinds of valves including control valves meet the design requirements;

2 examine the connection of the main and standby power supplies of the system;

3 examine the temperature of the room where the water storage facilities in cold and severe cold areas whose temperature shall not be lower than 5˚C;

4 examine the control panels and display signal status of the alarm controllers and pump control cabinets (panels); and

5 examine whether the marking such as the signs and instructions of the system are correct, clear, complete and located in the correct places.

6.0.8 The following items of the system shall be examined once each month:

1 examine the appearance of the system components which shall be free from collisional deformation and other mechanical damages;

Annex A Simulated fire Test for the Water Mist Fire Extinguishing System

A.1 General Provisions

A.1.1 The model for the simulated fire test shall ensure the similarity of the fire model to the actual engineering applications and shall be determined in accordance with the following factors:

1 the test fuel shall be capable of representing the fire characteristics of the actual protection objects;

2 the geometrical characteristics of the test space is similar to that of the actual enclosure;

3 the environmental conditions of the test space including ventilation are similar to those of actual engineering applications; and

4 the simulation test applications of the system are the same as the design applications of the system.

A.1.2 The ignition method and pre-combustion time for the actual fire simulation test shall be similar to the possible fires.

A.2 Equipment Rooms with the Volume not More than 260 m^3

I Basic requirements

A.2.1 The simulated test space shall meet the following requirements:

1 the test space shall be relatively closed whose length, width and height shall be determined in accordance with the space of the actual enclosure and the width is preferably not more than 7.5 m and the length is preferably not more than 8.0 m;

2 provide a door 0.8 m wide and 2.0 m high in the wall parallel to the equipment model with the distance from the door to a wall corner preferably 2.7 m. Except that the door is in an open position during a 2 MW spray fire test with baffle, the door shall be in a closed position for other tests; and

3 during the water mist spraying and fire extinguishing process, all openings of the test space shall be in a closed position.

A.2.2 The equipment in the protection space can be simulated with steel sheet and it shall meet the following requirements:

I – oil tray (1 m × 1 m);

J – oil tray;

K – steel sheet;

L – baffle;

M – door.

Figure A.2.2 – Test space and test model

A.2.3 The simulated fire source is a spray fire or oil tray fire in accordance with the fire characteristics of the protection objects and shall meet the following requirements:

1 when the combustible liquid used in the equipment room is C-class liquid, the test fuel is preferably diesel number 0;

2 when the combustible liquid used in the equipment room is B- and C-class liquids, the test fuel is preferably normal heptane;

3 for the spray fire, the spray angle of the fuel nozzles is preferably 80° and the pressure in front of the nozzles 0.86 MPa; for the spray fire 1 MW, its fuel supply flow rate shall be (0.03 ± 0.005) kg/s; for a 2 MW spray fire, its fuel supply flow rate shall be (0.05 ± 0.002) kg/s; and

4 for an oil tray fire, the test oil tray shall be square, area preferably 1.0 m^2 and height 100 mm. Add fuel after adding water at the bottom of the oil tray with the thickness of the fuel layer preferably not less than 20 mm and the distance from the liquid level to the upper edge of the oil tray preferably 300 mm.

A.2.4 The layout of the simulated fire source shall meet the following requirements:

1 for the unbaffled spray fire, the fuel nozzles are arranged over the vertical center line of the horizontally placed steel sheet. The height from the fuel nozzles to the steel sheet is preferably 0.3 m to 1.7 m. During the test, the spray fire is preferably sprayed along the vertical center line of the steel sheet. See Figure A.2.4-1 for the test layout;

2 for the baffled spray fire, the fuel nozzles are placed under the horizontally placed steel sheet and located between two baffles with the distance to the ground preferably 500 mm. During the test, the spray fire is preferably sprayed to the central position of the opposite wall. See Figure A.2.4-1 for the test layout;

A.2.7 For the equipment rooms with the volume greater than 130 m^3, the baffled spray fire test shall also be carried out in a small test space and shall meet the following requirements:

1 use a baffle perpendicular to the horizontally placed steel sheet in the test space to divide a small test space with the volume of 130 m^3 in accordance with A.2.1 of this Standard and provide a door 0.8 m wide and 2.0 m high. The door shall remain in the open position during the test;

2 the simulated fire source shall be the 2 MW spray fire specified in A.2.3 of this Standard. The layout of the fire source shall meet Article 2 of A.2.4 of this Standard; and

3 the test shall meet Article 2 of A.2.6 of this Standard. When the system is activated manually during the test, only the water mist nozzles in the 130 m^3 small test space shall be opened.

A.2.8 The test results shall meet the following requirements:

1 the time from spraying water mist to extinguishing fire shall not be more than 15 min;

2 no after-combustion shall occur after fire extinguishing; and

3 there shall be fuel left after fire extinguishing.

III Turbine rooms

A.2.9 The turbines can be simulated with steel sheet and the test shall meet the following requirements:

1 place a 50 mm thick hot-rolled steel sheet horizontally on 4 steel supports and make the steel sheet located on the center line of the long side direction of the test space. The steel sheet dimensions shall be 1.0 m × 2.0 m and the distance to the ground 1.0 m.

place another 2 pieces of steel sheet 1 mm thick and 1.0 m wide also on the steel supports with one side of each steel sheet preferably connected with one side of the hot-rolled steel sheet and the other side preferably extending to the opposite wall and connected perpendicularly with the wall.

On both sides of the horizontally placed steel sheet tilting 45° upwards, fix 2 pieces of steel sheet 1 mm thick with the horizontal distance of the tops of the steel sheet on both sides 2.0 m and the distance from the tops to the ground 1.5 m;

2 when the baffled fire test is carried out, 2 baffles 1.0 m wide and 0.5 m wide shall be placed under the horizontally placed steel sheet; and

3 during the water mist spraying and fire extinguishing process, all openings of the test space shall be in a closed position.

A.3.2 The equipment in the protection space can be simulated with steel sheet and steel tube and the test shall meet the following requirements:

1 the model is made of steel sheet 5 mm thick. It is 3.0 m in length, 1.0 m in width and 3.0 m in height;

2 the model shall be provided with 2 steel tubes of diameter 0.3 m and length 3.0 m and a baffle 3.5 m long, 0.7 m wide and 5 mm thick;

3 the model shall be provided with steel sheet fence around it. It is 6.0 m in length, 4.0 m in width and 0.75 m in height;

4 a square oil tray of area 4.0 m^2 is placed under the model and the height of the oil tray is preferably 0.25 m. A square oil tray of 1.0 m × 3.0 m shall be placed on the top of the model and the height of the oil tray is preferably 100 mm; and

5 see Figure A.3.2 for the layout of the test space, equipment model and test facilities.

Nominal oil pressure (MPa)	0.82	0.86	15.0
Fuel supply flow rate (kg/s)	0.16 ± 0.01	0.03 ± 0.005	0.05 ± 0.002
Fuel temperature (˚C)	20 ± 10	20 ± 10	20 ± 10
Heat release rate (MW)	5.8 ± 0.6	1.1 ± 0.1	1.8 ± 0.2

3 for the oil tray fire, the test oil trays are of square and rounded shapes. The square oil trays are preferably 100 mm high and the dimensions are 0.3 m × 0.3 m and 1.0 m × 1.0 m. The rounded oil trays are preferably 180 mm high whose diameter shall be 1.6 m. Add fuel after adding water at the bottom of the oil tray with the thickness of the fuel layer preferably not less than 20 mm and the distance from the liquid level to the upper edge of the oil tray preferably 300 mm; and

4 for the wood crib fire, the wood crib shall be formed by 8 layers of battens piled up in order with 4 battens for each layer. Each batten is made of spruce, fir or pine wood of an equivalent density, with the length preferably 305 mm and the cross section preferably 38 mm × 38 mm. The length, width and height of the wood crib are 350 mm, 305 mm and 305 mm respectively and the weight is preferably 5.4 kg to 5.9 kg. Before the test, the wood crib shall be stored at (49 ± 5) ˚C for 16 h at least.

A.3.4 The layout of the simulated fire source shall meet the following requirements:

1 for the unbaffled spray fire, the fire source shall be the lower pressure spray fire and high pressure spray fire specified in Table A.3.3 of this Standard. The fuel nozzles shall be located on the top of the model (Figure A.3.2-2 of this Standard);

2 for baffled spray fire, the fire source shall meet the requirements of the low pressure spray fire of Table A.3.3. The fuel nozzles shall be located under the baffle (Figure A.3.2-2 of this Standard). During the test, the fuel nozzles preferably faces the wall without openings and shall spray horizontally along the length direction of the model;

3 for the tilted spray fire, the fire source shall meet the requirements of the low pressure spray fire in Table A.3.3. The fuel nozzles shall be located on the top of the model (Figure A.3.4). The nozzles preferably form a 45° spray to the upper surface of the model and impact the barrier bars Φ 15 mm;

7 for the flowing fire, the fuel shall be normal heptane. During the test, the fuel is injected into the square oil tray on the top of the model through the oil tube. Make the fuel flow at the rate of 0.25 kg/s through the slot on the side of the top oil tray (Figure A.3.2-2 of this Standard). The heat release rate shall be 28 MW.

A.3.5 The oxygen concentration tester shall be placed at a position far from the openings in the test space, with a measuring range preferably 0 to 25% (V/V). During the whole test, the oxygen concentration in the test space is preferably not lower than 16%.

II Hydraulic stations, lubricating oil stations, diesel generator rooms and fuel oil boiler rooms and so on

A.3.6 The water mist nozzles are preferably placed on the top inside of the test space.

A.3.7 The selection of the simulated fire source shall meet the following requirements:

1 for the equipment rooms where no three-dimensional spray fire risk exists, select the simulated fire source specified in Articles 5 to 7 of A.3.4 of this Standard to carry out the test; for the equipment rooms where three-dimensional spray fire risks exist, select the simulated fire source specified in Articles 1 to 7 of A.3.4 of this Standard to carry out the test; and

2 when the combustible liquid used in the equipment rooms is a class-C liquid, normal heptane can be replaced by normal heptane in the simulated fire source specified in Articles 5 to 7 of A.3.4 of this Standard.

A.3.8 The test procedure shall meet the following requirements:

1 for the spray fire, activate the system manually after ignition of fuel mist and pre-combustion for 15 s and record the fire extinguishing time and the working pressure in front of the water mist nozzles;

2 for the baffled spray fire 1 MW and oil tray fire 0.1 m^2, first ignite the fuel oil tray fire, then ignite the oil mist after the pre-combustion for 105 s, activate the system manually after the pre-combustion of oil mist for 15 s and meanwhile record the fire extinguishing time and the working pressure in front of the water mist nozzles;

3 for the baffled oil tray fire, activate the system manually after igniting the oil tray and pre-combustion for 15 s and record the working pressure in front of the water mist nozzles;

4 for the wood crib fire and oil tray fire, activate the system manually after igniting the oil tray and pre-combustion for 15 s and record the working pressure in front of the water mist nozzles; and

5 for the flowing fire, ignite normal heptane and activate the system manually after normal heptane overflows and flows down along the slot, and record the fire extinguishing time and the working pressure in front of the water mist nozzles.

A.3.9 Test result shall comply with the following requirements:

1 for the spray fire, the time from spraying water mist to extingushing fire shall not be more than 15 min and there shall be no after-combustion;

2 for the baffled spray fire 1 MW and oil tray fire 0.1 m^2, the system shall be capable of extinguishing the spray fire and suppressing the oil tray fire. The time from spraying water mist to extinguishing fire shall not be more than 15 min and there shall be not after-combustion;

3 for the baffled oil tray fire, the system shall be capable of suppressing the oil tray fire;

4 for the wood crib fire and oil tray fire, the system shall be capable of extinguishing oil tray fire and wood crib fire. The time from spraying water mist to extinguishing fire shall not be more than 15 min and there shall be not after-combustion; and

5 for the flowing fire, the system shall be capable of extinguishing the flowing fire. The time from spraying water mist to extinguishing fire shall not be more than 15 min and there shall be not after-combustion.

III Turbine rooms

A.3.10 The simulated fire extinguishing test shall meet the following requirements:

1 use the simulated fire source specified in Articles 1 to 7 of A.3.4 of this Standard to carry out the test and use diesel to replace normal heptane to carry out the test specified in Articles 5 to 7 of A.3.4 of this Standard; and

2 the test procedure and test results shall be as specified in A.3.8 and A.3.9 of this Standard.

A.3.11 Use the test model specified in A.2.9 of this Standard for the mist spray cooling test and carry out the test in accordance with A.2.11 of this Standard.

A.4 Cable Tunnels and Cable interlayers

A.4.1 The simulated test space for cable tunnels shall meet the following requirements:

1 the height of the test space is preferably more than 2.75 m. The width is preferably not less than 1.60 m. the length of the tunnels shall not be less than the design minimum protection length of the system; and

Table D.0.2 – Records of quality inspection for the installation of the water mist fire extinguishing system

Project name		Builder	
Name and number of construction standard		Supervisor	
Name of sub-sectional project	System installation		
Name of sub-divisional project	Requirements of this Standard	Inspection Records and evaluation of the Builder	Acceptance records of the Supervisor
Installation of water storage and gas storage cylinder set	Article 1 of 4.3.3		
	Article 2 of 4.3.3		
	Article 3 of 4.3.3		
Installation of pump set and control cabinets	Article 1 of 4.3.4		
	Article 2 of 4.3.4		
	Article 1 of 4.3.5		
	Article 2 of 4.3.5		
	Article 3 of 4.3.5		
Installation of valve set	Article 1 of 4.3.6		
	Article 2 of 4.3.6		
	Article 3 of 4.3.6		
	Article 4 of 4.3.6		
Installation of pipes	Article 1 of 4.3.7		
	Article 2 of 4.3.7		
	Article 3 of 4.3.7		
	Article 4 of 4.3.7		
	Article 5 of 4.3.7		
Installation of nozzles	Article 1 of 4.3.11		
	Article 2 of 4.3.11		
	Article 3 of 4.3.11		
	Article 4 of 4.3.11		
	Article 5 of 4.3.11		
Conclusions	Project leader of the Builder: (Signature and seal) (Date)	Supervising Engineer: (Signature and seal) (Date)	

D.0.3 The records of pipe washing during the construction process of the system shall be kept by the quality inspector of the builder in accordance with Table D.0.3; they will be examined by the supervising engineer who shall give examination conclusions.

Table D.0.3 – Records of pipe network washing for the water mist fire extinguishing system

Project name					Owner		
Builder					Supervisor		
Pipe section no.	Material	Washing					Conclusions and opinions
		Medium	Pressure (MPa)	Flow rate (m/s)	Flow capacity (L/s)	Number of washings	
Conclusions	Project leader of the Builder: (Signature and seal) (Date)			Supervising Engineer: (Signature and seal) (Date)			Project leader of the Owner: (Signature and seal) (Date)

D.0.4 The records of pressure testing during the construction process of the system shall be kept by the quality inspector of the builder in accordance with Table D.0.4; they will be examined by the supervising engineer who shall give examination conclusions.

Table D.0.4 – Records of pressure testing for the water mist fire extinguishing system

Project name					Owner		
Builder					Supervisor		
Pipe section no.	Material	Design working pressure (MPa)	Temperature (°C)	Conclusion			
				Medium	Pressure (MPa)	Time (min)	Conclusions and opinions
Conclusions	Project leader of the Builder: (Signature and seal) (Date)			Supervising Engineer: (Signature and seal) (Date)			Project leader of the Owner: (Signature and seal) (Date)

D.0.5 The records of acceptance of concealed work during the construction process of the system shall be kept by the quality inspector of the builder in accordance with Table D.0.5; they will be examined by the supervising engineer who shall give examination conclusions.

Name of sub-divisional project	Requirements of this Standard	Inspection Records and evaluation of the Builder	Acceptance records of the Supervisor
Debugging of pump set	Article 1 of 4.4.3		
	Article 2 of 4.4.3		
	Article 3 of 4.4.3		
	Article 4 of 4.4.3		
	4.4.4		
Debugging of control valves	Article 1 of 4.4.5		
	Article 2 of 4.4.5		
Linkage test	4.4.6		
	Article 1 of 4.4.7		
	Article 2 of 4.4.7		
	Article 3 of 4.4.7		
	4.4.8		
	4.4.9		
Conclusions	Project leader of the Builder: (Signature and seal) (Date)	Supervising Engineer: (Signature and seal) (Date)	

Control valves of the self-contained system	Examination of operation	
Pipes, supports, hangers and fittings	Appearance and fastness degree	
Water source	Testing water supply capacity by activating the manual testing valve of the fire pump	Once each year
Water storage tanks, filters, pipes and fittings and other system components	Examination of completeness, washing and de-slagging	
Pipe behind control valves	Purging	
Water storage tanks, water storage containers and other water storage facilities	Regular change of storage water	
System simulated linkage function test	System operation function	

G.0.2 The records of maintenance and management for the system after regular inspections and tests shall be kept in accordance with Table F.0.2. (Translator note: should be “G.0.2”. However, there is no “Corrigendum” issued so far.)

Table G.0.2 – Records of maintenance and management for the system after regular inspections and tests

user						
Enclosure/ protection object						
Inspection type (monthly/ quarterly/ annual)						
Inspection date	Inspection item	Content of inspection or test	Result	Existing problem and handling	Inspector (signature)	Responsible person (signature)
Remark						

NOTE:

Explanation of Wording in This Standard

1 In order to differentiate the articles of this Standard for the convenience of implementation, the words with different strictness degrees are explained as follows:

1) indicating that it is very strict and must do:

the positive word “must” and the negative word “strictly prohibit”;

2) indicating that is strict and should be done under normal conditions:

the positive word “shall” and the negative word “shall not” or “cannot”;

3) indicating that a few selections can be made but it should be done like this first when the conditions are ready:

the positive word “preferably” and the negative word “not preferably”;

4) indicating that there are selections and it can be done like this under certain conditions, the word “may” is used.

2 The articles indicating implementation in accordance with other relevant standards are written as “shall be as specified in...” or “shall be carried out in accordance with...”.

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