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NATIONAL STANDARD OF THE
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ICS 13.220.50
C 82

GB 15930-2007

Replacing GB 15930-1995, GB 15931-1995

Fire dampers for building venting and smoke-venting system

建筑通风和排烟系统用防火阀门

Issued on: April 27, 2007

Implemented on: January 01, 2008

**Issued by: General Administration of Quality Supervision, Inspection and
Quarantine of PRC;**

Standardization Administration of PRC.

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Fire dampers for building venting and smoke-venting system

1 Scope

This standard specifies the terms and definitions, classification and marking, materials and accessories, requirements, test methods, inspection rules, marking, packaging, transportation, storage of fire dampers, fire dampers in smoke-venting system and smoke dampers (hereinafter referred to as valves) for building ventilation, air conditioning, smoke exhaust systems.

This standard is applicable to fire dampers installed in the ventilation and air conditioning system of industrial and civil buildings and underground buildings as well as the fire dampers in smoke-venting system and smoke dampers installed in the mechanical smoke exhaust systems of industrial and civil buildings and underground buildings.

2 Normative references

The provisions in following documents become the provisions of this standard through reference in this standard. For the dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this standard; however, parties who reach an agreement based on this standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 191 Packaging - Pictorial marking for handling of goods (GB/T 191-2000, eqv ISO 780:1997)

GB/T 1804-2000 General tolerances - Tolerances for linear and angular dimensions without individual tolerance indications (eqv ISO 2768-1:1989)

GB/T 2624 Measurement of fluid flow by means of orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full

GB 4717-1993 General technical conditions for fire alarm control unit

GB 9969.1 General principles for preparation of instructions for use of industrial products

GB/T 9978-1999 Fire-resistance tests - Elements of building construction

(neq ISO/FDIS 834-1:1997)

GB/T 13306 Plates

GB/T 13384 General specification for packaging of mechanical and electrical products

GB/T 14436 General principles of industrial product guarantee documents

3 Terms and definitions

The following terms and definitions apply to this standard.

3.1

Fire damper

A valve which is installed in the air supply and return pipeline of the ventilation and air conditioning system. It is normally opened; it is closed when the smoke temperature in the pipeline reaches 70 °C in case of fire; it meets the requirements for smoke leakage and fire integrity within a certain period of time, functions to barrier the smoke and fire.

Fire dampers generally consist of components such as valve bodies, blades, actuators, temperature sensors.

3.2

Fire damper in smoke-venting system

A valve which is installed in the pipeline of the mechanical smoke exhaust system. It is normally opened; it is closed when the smoke temperature in the smoke exhaust pipeline reaches 280 °C in case of fire; it meets the requirements for smoke leakage and fire integrity within a certain period of time, functions to barrier the smoke and fire.

Fire damper in smoke-venting system generally consists of components such as valve bodies, blades, actuators, temperature sensors.

3.3

Smoke damper

A valve which is installed at the end of each branch pipe of the mechanical smoke exhaust system (smoke gas suction). It is normally closed and meets the requirements of air leakage, can be opened manually or powered in case of fire or where smoke exhaust is required, functions to exhaust smoke. The valve which is equipped with a decorative opening or subjected to decorative

Example 2: PFHF WSDc-Φ1000 indicates a fire damper in smoke-venting system which has a temperature sensor automatic close, manual close, electronically controlled electromagnet close, remote reset functions, as well as a nominal diameter of 1000 mm.

Example 3: PYF SDc-K-400X400 indicates a smoke damper which has manual open, electronically controlled electromagnet open, feedback function of the opening position signal of valve, as well as a nominal diameter of 400 mm X 400 mm.

5 Materials and accessories

5.1 Materials and components

5.1.1 Valve body, blade, baffle, actuator's bottom plate and outer casing should be made of such materials as cold-rolled steel plate, galvanized steel plate, stainless-steel plate or inorganic fireproof board.

5.1.2 The decorative opening of the smoke damper should be made of such materials as aluminum alloy, steel plate.

5.1.3 The important moving parts such as ratchet (cam) in bearings, bushings, actuators are made of corrosion-resistant materials such as brass, bronze, stainless-steel.

5.1.4 The production of various types of springs shall comply with the requirements of the corresponding national standards.

5.2 Accessories

5.2.1 The actuator of the valve shall be a product that has passed the testing of the testing organization as authorized by the state.

5.2.2 The temperature sensor element of the actuator of the fire damper or the fire damper in smoke-venting system shall be marked of its nominal action temperature.

6 Requirements

6.1 Appearance

6.1.1 The plate on the valve shall be firm. The marking shall be clear and accurate.

6.1.2 The surface of each component of the valve shall be smooth and flat. It shall not have such defects as cracks, craters, obvious irregularities, hammer

6.6 Manual control

6.6.1 Fire damper or fire damper in smoke-venting system should have manual closing mode. the smoke damper shall have manual opening mode. Manual operation shall be convenient, flexible, reliable.

6.6.2 The operating force for manual close or open shall not exceed 70 N.

6.7 Electric control

6.7.1 Fire damper or fire damper in smoke-venting system should have an electric close mode. The smoke damper should have an electric open mode. A valve which has a remote reset function shall, after energized and actioned, have a signal output which indicates the position of the valve's blade.

6.7.2 The working voltage of the electronic control circuit in the valve's actuator should adopt the rated working voltage of DC24 V. The rated working current shall not exceed 0.7 A.

6.7.3 When the actual power supply voltage is lower than the rated working voltage by 15% and higher than the rated working voltage by 10%, the valve shall be able to be electrically controlled.

6.8 Insulation performance

The insulation resistance between the external live terminal and the valve body which has insulation requirements shall, under normal temperature, be more than 20 MΩ.

6.9 Reliability

6.9.1 Closing reliability

After 50 close-open tests of the fire damper or the fire damper in smoke-venting system, each component shall be free from obvious deformation, wear, or other damages that affect the sealing performance. Meanwhile the blades can still be closed flexibly and reliably from the open position.

6.9.2 Opening reliability

6.9.2.1 After 50 close-open tests of smoke dampers, the components shall be free from obvious deformation, wear, or other damages which affect the sealing performance. Both electric and manual operation shall be started immediately.

6.9.2.2 After 50 close-open tests of smoke dampers, under the conditions of maintaining the static gas-pressure difference before and after the tests at 1000 Pa ± 15 Pa, both electric and manual operation shall be started immediately.

7.2 Appearance

The appearance quality of the valve is checked by visual inspection plus hand-touching.

7.3 Tolerance

The linear dimensional tolerances of the valves are measured by a steel tape measure. The accuracy of the steel tape measure is ± 1 mm.

7.4 Drive torque

7.4.1 Test equipment

A spring dynamometer or other dynamometer, which has an accuracy of grade-2.5. A steel tape or ruler, which has an accuracy of ± 1 mm.

7.4.2 Test procedure

7.4.2.1 After fixing the fire damper or the fire damper in smoke-venting system according to the state of use, remove the weight, spring, motor or pneumatic parts that generate the closing force. Use the dynamometer to pull the shaft of main blade, to make it change from full-open state to the close state. When the blade is closed, read out the maximum force as required by the shaft of main blade and measure the arm of force. Calculate the maximum torque. The formula for calculating the torque is:

$$M = F \cdot h \quad \text{..... (1)}$$

Where:

M - Torque, in Newton • meters (N • m):

F - Pull force, in Newton (N);

h - Arm of force, in meters (m).

7.4.2.2 Measure and calculate the driving torque which is actually applied to the shaft of main blade of the fire damper or the fire damper in smoke-venting system by the weight, spring, motor or pneumatic parts. The driving torque is calculated according to formula (1).

7.4.2.3 Calculate the ratio of the driving torque of the shaft of main blade of the fire damper or the fire damper in smoke-venting system to the required torque.

7.5 Reset function

Enter the electronic control signal or manually operate the reset mechanism, to visually check the reset of valve.

manually operated handle, drawstring or button. Use the dynamometer to apply the force to it to make the valve be close or open. The measured force is the manual closing or opening force.

7.7.2.2 Visually check whether the operation of valve is convenient, flexible, reliable.

7.8 Electric control

7.8.1 Output signal of blade's position

Allow the valve to close or open. Connect the reset circuit of the actuator. The valve shall be opened or closed. Use a multimeter to measure the output signal at the position where the blade of valve is located.

7.8.2 Rated current and rated voltage

The rated working voltage and rated working current of the electronically controlled circuit in the valve's actuator are measured by a voltmeter and an ammeter which have an accuracy of not less than grade-0.5 and a range of not more than twice the actual measured value.

7.8.3 Resistance to voltage fluctuations

7.8.3.1 Test equipment

DC regulated power supply. The maximum output voltage is 30 V.

7.8.3.2 Test procedure

7.8.3.2.1 Allow the valve to fully open or close. Connect the DC regulated power supply to the electronically controlled circuit in the actuator. Adjust the output voltage of the DC regulated power supply, so that its value is 15% lower than the rated working voltage of the valve. Connect the control circuit. The valve shall close or open.

7.8.3.2.2 Disconnect the control circuit. Fully open or close the valve. Adjust the output voltage of the DC regulated power supply, so that its value is 10% higher than the rated working voltage of the valve. Connect the control circuit. The valve shall close or open.

7.9 Insulation performance

The insulation resistance of valve's electrical appliances shall be measured according to the provisions of 5.8.3 of GB 4717-1993. The test equipment shall comply with the provisions of 5.8.4 of GB 4717-1993.

7.10 Reliability

water. The mass concentration is $(5 \pm 0.1\%)$. The pH is controlled between 6.5 and 7.2.

It shall control the amount of salt spray between $1 \text{ mL} / (\text{h} \cdot 80 \text{ cm}^2) \sim 2 \text{ mL} / (\text{h} \cdot 80 \text{ cm}^2)$.

7.11.2 Accuracy of measuring instruments

Temperature: $\pm 0.5 \text{ }^\circ\text{C}$;

Humidity: $\pm 2\%$.

7.11.3 Test procedure

7.11.3.1 Before the start of test, it shall use the detergent to rinse the grease from the surface of valve. Install the valve in the salt spray box (chamber). Allow its opening to face upwards. Make the axis of each blade of the valve be at an angle of $15 \sim 30$ degrees to the horizontal plane.

7.11.3.2 During the test, the valve volume is opened. Use 24 h as 1 cycle. First continuously spray for 8 h. Then stop for 16 h. Carry out 5 cycles of tests in total.

7.11.3.3 During salt spray, keep the temperature in the salt spray box (chamber) at $35 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$ and the relative humidity of more than 95%. When the spray is stopped, do not heat. Close the salt spray box (chamber). Let it cool naturally.

7.11.3.4 After the test is completed, remove the valve. Dry it at room temperature for 24 h. Carry out open-close test for the valve.

7.12 Air leakage at ambient temperature

7.12.1 Test equipment

7.12.1.1 Basic equipment

It includes two parts: gas-flow measurement system and pressure measurement & control system.

7.12.1.2 Gas-flow measurement system

It consists of a connecting pipe, a gas-flow meter, an induced draft fan system.

- a) Connecting pipe: The valve is connected to the gas-flow meter through a connecting pipe. The connecting pipe is made of steel plate which has a thickness of not less than 1.5 mm. For rectangular valves, the width and height of the pipe's opening correspond to the outlet size of the valve. The length of the pipe is twice the diagonal of the opening, at most 2 m. For round valves, the diameter of the pipe opening corresponds to the outlet

P_2 - The gas pressure in front of the orifice plate as measured according to 7.12.3.2, in Pascals (Pa);

Q_1 - The air leakage as measured according to 7.12.3.1, in cubic meters per hour (m^3/h);

T_1 - The gas temperature in the pipe as measured according to 7.12.3.1, in degrees Celsius ($^{\circ}\text{C}$);

B_1 - The atmospheric pressure as measured according to 7.12.3.1, in Pascals (Pa);

P_1 - The gas pressure in front of the orifice plate as measured according to 7.12.3.1, in Pascals (Pa).

7.13 Fire resistance

7.13.1 Test equipment

7.13.1.1 Basic equipment

It includes four parts: test furnace for fire resistance, gas-flow measurement system, temperature measurement system, pressure measurement & control system. Between the test furnace and the valve, there is a connecting pipe which is made of steel plate of not less than 1.5 mm thickness. The sizes of opening correspond to the inlet sizes of the valve. The length is more than 0.3 m.

7.13.1.2 Test furnace of fire resistance

The test furnace of fire resistance shall meet the temperature-rise conditions as specified in 5.1 of GB/T 9978-1999 and the pressure conditions as specified in 5.2.

7.13.1.3 Gas-flow measurement system

The gas-flow measurement system is the same as in 7.12.1.2.

7.13.1.4 Temperature measurement system

The temperature in the furnace (temperature of test piece's fire-facing side) is measured by a thermocouple which has a wire diameter of 0.75 mm ~ 1.00 mm. The hot end extends from the casing for a length of not less than 25 mm. The number of thermocouples shall not be less than 5, one of which is located at the center of the valve's fire-facing side, the remaining 4 are located at the center of one quarter area of the valve. The distance between the measuring point and the valve shall be controlled within 50 mm~ 150 mm during the test. The temperature of the flue gas in the pipe is measured by a thermocouple

the induced draft fan system, so that the differential pressure of the gas upstream and downstream it is maintained within the range of 300 Pa ±15 Pa.

7.13.5.4 Control the pressure in the furnace to meet the pressure conditions as specified in 5.2 of GB/T 9978-1999.

7.13.5.5 Measure and record the differential pressure on both sides of the orifice plate, the gas pressure in front of the orifice plate, the temperature of the gas in the measuring pipe behind the orifice plate. The time interval is not more than 2 min. Use the calculation formula of GB/T 2624 to calculate the gas-flow rate at each time point.

7.13.5.6 Measure and record the atmospheric pressure during the test.

7.13.5.7 Calculation formula for the smoke leakage of the valve during fire resistance test:

$$Q = \frac{Q_{\text{standard}}}{S} \quad \dots\dots\dots (6)$$

$$Q_{\text{standard}} = Q_{\text{standard } 3} - Q_{\text{standard } 1} \quad \dots\dots\dots (7)$$

$$Q_{\text{standard } 3} = Q_3 \times \frac{273}{273 + T_3} \times \frac{B_3 - P_3}{101\,325} \quad \dots\dots\dots (8)$$

Where:

Q - The smoke leakage per unit area of the valve during the fire resistance test (standard state), in cubic meters per square meter [$\text{m}^3 / (\text{m}^2 \cdot \text{h})$];

Q_{standard} - The smoke leakage of the valve during fire resistance test (standard state), in cubic meters per hour (m^3/h);

S - The net opening area of the valve, in square meters (m^2);

$Q_{\text{standard } 3}$ - The sum of the smoke leakage of the valve and the system during the fire resistance test (standard state), in cubic meters per hour (m^3/h);

$Q_{\text{standard } 1}$ - The air leakage of system as calculated according to the formula (5) of 7.12.3.3 (standard state), in cubic meters per hour (m^3/h);

Q_3 - The smoke leakage at each time point as measured according to 7.13.5.5 during the fire resistance test, in cubic meters per hour (m^3/h);

T_3 - The temperature of the gas in the pipeline at each time point as measured according to 7.13.5.5 during the fire resistance test, in degrees Celsius ($^{\circ}\text{C}$);

B_3 - The atmospheric pressure during the fire resistance test, in Pascals (Pa);

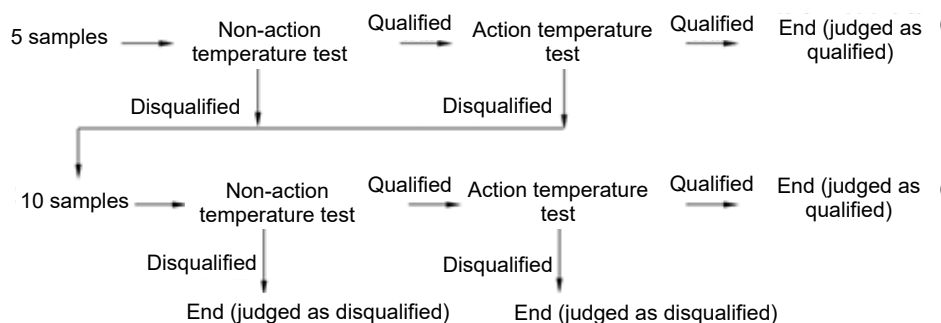
inspect the unqualified items. If the re-inspection is all qualified, this batch of products shall, except for the sample which fails to pass the first inspection, be judged as passing the type inspection. If there is still one item fails in the re-inspection, this batch of products are judged as failing to pass the type inspection.

8.2.3.2 For the temperature sensor in the fire damper and the fire damper in smoke-venting system, it shall take sample from the same batch of products. The quantity of samples is 15.

From 15 temperature sensors, select randomly 5 temperature sensors to carry out the non-action and action temperature test. For the non-action temperature test, if more than 80% of the samples does not action, the non-action temperature test is qualified. Otherwise, it requires re-inspecting the remaining 10 samples. If the re-inspection is qualified, it passes the non-action temperature test. Otherwise, it fails to pass the non-action temperature test.

After the temperature sensor passes the non-action temperature test, carry out the action temperature test. If all temperature sensors action, it passes the action temperature test. Otherwise, it shall re-inspect the remaining samples. If it passes the re-inspection, it passes the action temperature test. Otherwise, it fails to pass the action temperature test.

The inspection process flow of the non-action and action temperature test of the temperature sensor is as follows:



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