GB 7956-1998

Preface

Since there's no established international standard for fire-fighting vehicles, such standard differs a lot between major foreign countries in terms of contents and requirements. Thus, this STANDARD is stipulated in accordance with the specific national conditions for the production and use of fire-fighting vehicles, in compliance with the relevant criteria and regulations of automobiles, and with reference to the overseas fire-fighting vehicles standards.

Compared with the previous edition, the revised STANDARD contains the following modifications: change of compilation of the standard according to GB/T1.1-1993; coordination of the manufacturer's maximum total mass of fire-fighting vehicle (of three types: light, medium and heavy-duty) and mass range of loaded extinguishant; cancellation of regulations on flow volumes of the fire-fighting pumps installed on various types of fire-fighting vehicles; full revision of the braking performance with reference to the new STANDARD of automotive industry; deletion of the last Chapter (Examination Rules) for that regulations of approval test and of regular examinations on quality have been established.

Fire-fighting Vehicle Standard compiled with reference to this STANDARD should be implemented with and subject to the revised edition.

This STANDARD is proposed by the Public Security Bureau of People's Republic of China.
This STANDARD is governed and maintained by the National Technical Committee for Standardization.
This STANDARD is drafted by: Shanghai Fire-fighting Science Research Institute under the Ministry of Public Security; China Automotive Technology & Research Center.
Drafters: Li Enxiang, Fan Hua, Wu Jinghua, Waiming, Li Baozhong, Wang Yongfu, Yan Jingmao.
This STANDARD is first issued on: June 1987.
This STANDARD is first revised on: July 1998.

National Standard of People's Republic of China

GB 7956-1998

In substitute for GB 7956-87

[English in original text: Fire Performance Requirements and Test Methods for Vehicle]

Fire Performance Requirements & Test Methods for Fire Trucks [suggested]

1. Scope

Fire performance requirements and test methods for fire trucks have been stipulated in this STANDARD.

This STANDARD applies to the approval test and examination test of quality for such vehicles as Pumper Fire Truck ("Pumper"), Water-tank Fire Truck ("Water-tank Truck"), Foam Fire Truck ("Foam Truck"), Dry Powder Fire Truck e ("Dry Powder Truck"), Foam-Dry Powder Fire Truck ("Dual- extinguishant Truck"), Water-supply Fire Truck ("Water-supply Truck"), High-platform Fire Truck ("Platform Truck"), Elevating Spray Fire Truck ("Water Tower Fire Truck") and Aerial Ladder Fire Truck ("Aerial Ladder Truck") etc.

This STANDARD is not applicable to the foam fire engines for airport fire-fighting and rescuing.

2. Reference Standards

Certain clauses contained in the following Standards are quoted in this STANDARD as the standard clauses. All specified editions are valid as of the date of the publication of this STANDARD. All Standards are subject to further amendments, and each party using this STANDARD shall discuss for the possibility of using the latest edition of these Standards.

GB 150-1998 Steel Pressure Vessel

GB 6244-86 General Chassis Serial, Model, Basic Parameters and Technical Requirements for Vehicles

GB 6245-1998 Performance Requirements and Test Methods for Fire Pump

GB 7258-1997 Technical Conditions for Safe Operation of Automobiles

GB/T 12534-90 General Rules of Road Test Methods for Motor Vehicles

GB/T 12538-90 Measuring Methods for Height of Vehicle's Gravity Center

GB/T 12543-90 Test Methods of Acceleration Performance for Motor Vehicles

GB/T 12544-90 Test Methods of Maximum Speed for Motor Vehicles

GB/T 12673-90 Measuring Methods of Basic Dimensions for Motor Vehicles

GB/T 12674-90 Measuring Methods of Quality (Weight) Parameter for Motor Vehicles

GB/T 12678-90 Test Methods of Reliability Running for Motor Vehicles

GB/T 14172-93 Test Methods of Static Roll Stability for Motor Vehicles

GB 15090-94 Fire Hose Reel

GB 15308-94 General Technical Requirements for Foam Extinguishant

3 Definitions

The following definitions shall apply in this STANDARD.

3.1 Manufacturer’s Maximum Total Mass of Fire Truck Chassis

It indicates the manufacturer’s maximum total mass for the original model regulated by the automobile factories.

3.2 Manufacturer’s Maximum Axle Load of Fire Truck Chassis

It was approved on 15 July 1998 and implemented on 1st June 1996 by the China State Bureau of Quality & Technology Supervision.

It indicates the manufacturer's maximum axle load for the front/rear axle of the original model regulated by the automobile manufacturers or fire truck chassis factories. For fire trucks with double front/rear axles, it indicates the manufacturer's maximum axle load of double axles.

3.3 Curb Mass of Fire Truck
It indicates the mass of fire truck (fully equipped) in the condition that its chassis is adequately filled with regulated volume of coolant and fuel but without extinguishant loaded and passengers boarded.

3.4 Front/Rear Axles Load of Fire Truck at Curb Mass
It indicates the actual mass allocated to the front and rear axles when fire truck is at curb mass.
For those fire truck of double front or rear axles, it indicates the allocated mass on the double axles of vehicle.

3.5 Maximum Total Mass of Fire Truck
It indicates the mass of fire truck (fully equipped) in the condition that its chassis is filled with adequate coolant and fuel and with regulated volume/amount of extinguishant loaded and passengers onboard (including the driver).

3.6 Load of Front/Rear Axles of Fire Truck at Total Mass
It indicates the actual mass allocated to the front/rear axles of the fire truck at maximum total mass.
For fire truck of double front or rear axles, it indicates the allocated mass to the double axles of vehicle.

3.7 Light-duty Fire Truck
Manufacturer's total mass of the chassis: ＞1800kg and ≤6000kg

3.8 Medium-duty Fire Truck
Manufacturer's total mass of the chassis: ＞6000kg and ≤14000kg

3.9 Heavy-duty Fire Truck
Manufacturer's total mass of the chassis: ＞14000kg

3.10 Manned Platform
It indicates the manned working platform mounted on the top of the arm frame of a platform truck or on the ladder of a ladder truck.

3.11 Elevator Scoop
It's a powered manned platform moving along the ladder frame of the ladder truck.

3.12 Rated Load Capacity of Platform Truck
It indicates: under the safe and normal working conditions, and when the water monitor and water

jet are not working, the maximum load mass allowable on the man-carrying platform (not including the mass of various equipment fixed on the manned platform).

3.13 Rated Load Capacity of Aerial Ladder Truck
It indicates: under the safe and normal working conditions, and when the water monitor and water-jet are not working, the maximum load mass allowable on the manned platform (if the manned platform is mounted, the mass of such equipment shall not be counted into the rated load capacity).

3.14 Safe Operation Area for Elevating Fire Truck
It indicates the safe area for operation of the elevating fire truck within its rated load capacity.

3.15 Rated Operating Height of Platform Truck

It indicates: when the platform truck lifts the platform to the maximum height, the vertical distance from the upper-surface (of platform's base-plate) to the ground.

3.16 Rated Operating Height of Water Tower Fire Truck
It indicates: when the water tower fire truck lifts its spray monitor to the maximum height, the vertical distance from the axis of spray monitor (in a level condition) to the ground.

3.17 Rated Operating Height of Aerial Ladder Truck
It indicates: when the aerial ladder truck is expanded to its limit and elevated to the maximum elevation angle, the vertical distance from the top stair to the ground.

3.18 Standard Environmental Condition
Standard atmosphere condition (the air pressure) with temperature (including the water temperature) at 20℃.

3.19 Vacuum degree
It indicates the difference between the standard atmosphere pressure and the pressure created by the priming device in the priming pipes.

3.20 Priming Time
It indicates the time when the priming device of the fire truck starts working to the time fire pump's delivery gauge indicates the pressure value.

3.21 Vehicle Water-jet ("Water-jet" in short)
It indicates those that are fixed on the fire truck, including the fire monitor on the monitor platform; within this STANDARD; including fire water monitor ("water monitor"), air-foam monitor ("foam monitor"), dry powder monitor, double-purpose monitor and combined monitor.

3.22 Double-purpose Monitor
It indicates the single-pipe spray monitor with the function of air-foam spray and water jetting

3.23 Combined Monitor
It indicates the double-pipe water-jet with combination of any two of the water monitor, foam monitor, double-purpose monitor and dry powder monitor.

3.24 Effective Spray Time of Dry Powder Spray System
It indicates the time counted since the dry powder starts to spray at its stipulated maximum pressure that the internal pressure drops down to the stipulated lowest working pressure.

3.25 Spray Rate of the Dry Powder Spray System
It indicates the mass of the dry powder extinquishant sprayed within a unit time.

3.26 Effective Spray Rate of the Dry Powder Spray System
It indicates the average value of spray rate within the effective spray time.

3.27 Air-charging Time of Dry Powder Spray System
It indicates that the time counted from the moment the gas charged into dry powder tank (in rated charging volume) to the moment that the pressure inside the tank reaches the maximum working pressure.

3.28 Residual Powder Rate
It indicates: after the spray operation (in an effective spray time), the percentage between the residual powder and the original charged volume in the dry powder tank.

4 Performance Requirements

4.1 Performance Requirements of Complete Vehicles

4.1.1 Chassis

The chassis of fire truck must comply with the requirements in GB 6244.

4.1.2 Main Structure Parameters and Mass Parameters

See Table 1 for the main structure parameters and quality parameters of the fire-fighting truck and water-supply truck.

See Table 2 for the main structure parameters and quality parameters of the elevating fire truck.

In the table:

External dimension should be less than the listed value.

Approach angle and departure angle should not be smaller than the listed values.

Rated load capacity of the elevating fire truck should be no less than the listed value.

Vehicle Types	Models	Extinquishant Mass		External Dimension				
		Water/water-foam liquid	Dry Powder	Length	Width	Height	Approach Angle (°)	Departure Angle (°)
Pumper	Light-duty							
	Medium-duty							
Water Tank Truck	Medium-duty							
	Heavy-duty							
Foam Truck	Light-duty							
	Medium-duty							
	Heavy-duty							
Dry Powder Truck	Light-duty							
	Medium-duty							
	Heavy-duty							
Dual-extinguishant Truck	Medium-duty							
	Heavy-duty							
Water-supply Truck	Medium-duty							
	Heavy-duty							

Table 2: Main Structure Parameters and Quality Parameters of Elevating Fire Truck

Vehicle Types	Rated Operating Height	Rated Load Capacity	External Dimension			Approach Angle (°)	Departure Angle (°)
			Length	Width	Height		
Platform Truck							
Water Tower Fire Truck							

Aerial Ladder Truck							

4.1.2.2 When the drivers' cabin of the elevating fire truck is moved forward and lowered down , the approach angle should be no less than 16°.

4.1.2.3 The following values should be measured: the curb mass, front/rear axles mass (in curb mass condition), maximum total mass, front/rear axles mass in maximum total mass condition), horizontal position and height of centroid of Complete Vehicle.

4.1.2.4 When the fire truck is in its maximum total mass, the front/rear axles masses should all be within the range of the manufacturer's maximum axles load for fire truck chassis.

4.1.2.5 When the fire truck is at maximum total mass, the centroid height of complete vehicles shall meet the requirements for side-inclination stability in Article 3.7.1 of GB 72356-1997, and the test methods shall be in accordance with GB/T 14172-93.

4.1.3 Maximum Vehicle Speed and Acceleration Time

4.1.3.1 Measure the maximum vehicle speed of fire truck by using the methods specified in **5.3**, which should be no less than the value listed in Table 3.
Measure the time needed for accelerating from 0 to 60km/h, and the measured value should not be bigger than the value listed in Table 3.

Table 3: Maximum Speed and Acceleration Time from 0 to 62km/h of the Fire Truck

Vehicle Types	Models	Maximum Vehicle Speed (km/h)	Acceleration Time (s)
Pumper	Light-duty		
	Medium-duty		
Water-tank Truck	Medium-duty		
Dual-extinguishant Truck	Heavy-duty		
Foam Truck			
Dry Powder Truck			
Water-supply Truck			
Platform Truck			
Water Tower Fire Truck Aerial Ladder Truck			

4.1.3.2 For the fire truck reproduced from the light-duty off-road vehicle chassis, the maximum vehicle speed should be no less than 100km/h and the acceleration time from 0 to 80km/h should be no more than 30s.

4.1.4 Braking Performance

The braking performance and parking performance of the fire truck should meet the requirements for the braking system stipulated in GB 7258.

4.1.5 Rainproof Performance

Fire truck should feature better rainproof performance. After conducting the test in accordance with 5.5, no trace of water should be spotted in the drivers' cabin, passenger's cabin, equipment box and any other places where water may cause damages. .

4.1.6 Reliability

4.1.6.1 In the event that partial modification had been conducted on the chassis of the fire truck which will no affect its main technical performance, driving test of 5000km

(excluding running-in mileage) should be carried out in accordance with 5.6 to check the reliability of the improved vehicle chassis and fire-fighting equipment.
After the driving test, there should be no damage, displacement, crack, oil-leakage, water-leakage and gas leakage detected on the chassis and in the fire-fighting equipment system.
Operate each of the fire truck's each systems appropriately to make sure that their performances are in line with the designed specifications.

4.1.6.2 If the modifications on the fire truck's chassis can affect the main technical performance, conduct the test according to the regulations of GB 6244, and the test results should meet the regulated requirements.

4.1.7 Cooling of Engine
The cooling system of engine should ensure that the fire truck could be operated continuously for a long time.
See **4.2.6** for the detailed requirements.

Install the auxiliary cooler if necessary.

If water is used as the coolant medium in the auxiliary cooler, it should not be mixed with the water in the engine's cooling system. To ensure the normal operation temperature, adjust appropriately the flow volume of water in the auxiliary cooler.

4.1.8 Power Output Device
After a long period of time of continuous operation, the power output device in working should not generate any abnormal noise and be overheating. The temperature of the lubricant and bearing block should meet the regulations in **4.2.6.3**.

4.2 Performance Requirements for Fire Pump and Water System

4.2.1 Fire Pump

4.2.1.1 Performance of the fire pump mounted on the fire truck should meet the requirements in GB 6245.

4.2.1.2 Pressure-charged fire-fighting pump with the discharge pressure at above 600Kpa can be mounted to the elevating fire truck. The rated discharge pressure of such pump must meet the requirements of the elevating fire truck for normal operation (there should be some clear specifications). Apart from the vacuum priming performance, other performances of such pump should satisfy the requirements of GB 6245.

4.2.2 Airproof performance of Water Tank and Foam Liquid Tank
Water tank and foam liquid tank should be made of corrosion-resistant materials, or they must be treated with the anti-corrosion technology.

4.2.3 Air-tightness and Strength of Water-outlet Pipeline
Water-outlet pipeline should have good air-tightness performance. Set the test pressure at 1.1 times the maximum pressure the pipeline may bear, conduct the test in accordance with the steps regulated in **5.7.1,** and no leakage should be spotted throughout the whole pipeline.

4.2.3.2 Such pressure-bearing components as the outlet pipelines should be capable of passing the hydrostatic-pressure strength test. Under the condition that the test pressure is 1.5 times the maximum pressure the pipeline may bear, conduct the test using he methods regulated in **5.7.2**. And no crack, leakage or permanent deformation should be spotted throughout the whole pipeline.

4.2.4 Maximum Vacuum Degree and Tightness
In a standard environment condition, the maximum vacuum degree formed in the priming equipment of the fire truck should be no less than 85Kpa. Carry out the test in accordance with the methods regulated in **5.8,** the fall of the vacuum degree within 1 minute should be no more than 2.6Kpa (in the maximum vacuum degree condition)**.**

4.2.5 Pump Performance, Priming Time and Reliability at Maximum Suction Depth

4.2.5.1 Under the standard environmental condition, the maximum suction depth of the fire truck should be no less than 7m.

4.2.5.2 At the maximum suction depth, the flow and discharge pressure of the pump should meet the regulations in Table 4.

Table 4: Pump Performance at Maximum Suction Depth

Types of Fire Pump	Flow	Discharge Pressure
Fire pump of low-pressure, medium-low-pressure, high-low-pressure	50% of the rated low-pressure value	Not less than the low-pressure rated value
Medium-pressure fire pump	50% of the rated value	Not less than the rated value
High-pressure fire pump	50% of the rated value	Not less than the rated value

4.2.5.3 When the suction depth is at the maximum value, conduct the priming action in accordance with the methods stipulated in **5.9**. The priming time should be no more than the value regulated in Table 5.

Table 5: Priming Time

Rate Flow (L/s)	Priming Time (s)
<50	≤35
≥50，<80	≤50
≥80	≤80

Conduct the “priming time test” continuously for three times, and record the priming times measured. Test results of these three tests should be no higher than the regulated value in Table 5, and if so, the operating performance of the priming device can be deemed reliable.

4.2.6 Continuous Operation Hour

4.2.6.1 The fire truck of low-pressure, medium-pressure, high-pressure pump or combination-pump can only be operated for 4 continuous hours. The test should be carried out with the flow and pressure at their rated values for various working conditions.

a. For the fire truck equipped with low-pressure pump, it should be operated for 2 continuous hours at the rated flow volumes and discharge pressure; then it should be operated for another 2 continuous hours with the flow volume at 70% of the rated value and the discharge pressure at no less than 130% of the rated value.
b. For the fire truck equipped with medium-low-pressure pump, it should be operated for 2 continuous hours at the rated low-pressure and discharge pressure; then it should be operated for another 1 hour with the pressure at 50% of the rated value for the low-pressure pump and the discharge pressure no less than 1.8Mpa; and finally, it should be operated for another 1 hour under the combination condition.

c. For the fire truck equipped with high-low-pressure pump, it should be operated for 2 continuous hours at the low-pressure rated flow and discharge pressure; then it should be operated for another 1 hour at the high-pressure rated flow volume and discharge pressure; and finally, it should be operated for another 1 hour under the combination condition.
d. For the fire truck equipped with medium-low-pressure or high-pressure pump, it should be operated for 4 continuous hours at the rated flow volume and discharge pressure.

4.2.6.2 For the elevating fire truck, it should be operated for 4continuous hours at the rated flow and discharge pressure.

4.2.6.3 Conduct the test according to the methods regulated in **5.10**.
In the test, the engine, transmission and power output device of the fire truck should meet the following requirements:
a. Normal operation with no such problems as water-leakage or oil-leakage.
b. Temperature of the water discharged from the engine should be within the range of 80-90℃.
c. Temperature of oil in engine should be within the range of 50-95℃.
d. Temperature of lubricant in transmission and power output device should be lower than that of the maximum allowable operating temperature.
e. Temperature of output-axis's bearing block for the power output device should be within 100℃. When the approved power output device is adopted, the temperature of the output-axis's bearing block should be within its regulated value.

4.2.7 Over-loading Operation Performance
Conduct the test of over-loading operation by using the methods regulated in **5.11**. The engine and pump should be in normal operation condition and there should be no such problems as over-vibration or oil-leakage.

4.2.8 Water Monitor
For the fire truck equipped with the water monitor (including the double-purpose monitor and combined monitor), the flow, spray pressure and spray range should be no less than the regulated value by corporate technical document, and determine the flow and spay range at its rated spray pressure according to the regulations in **5.12** and **5.13**.

4.2.9 Rated values of the discharge pressure and flow of the fire truck should be marked at a conspicuous place for controlling and operating the discharge process.

4.3 Performance Requirements of Foam System

4.3.1 Foam Monitor
For the fire truck equipped with foam monitor, its performance should comply with regulations in Table 6 (including the foam-spraying performance of the fire truck with double-purpose monitor and combined monitor).

Table 6: Performance of the Foam Monitor

Foam Mixture Flow Volume (L/s)	Rated Spray Pressure (kPa)	Foaming Multiples （at 20℃）	25％ Drainage Time (at 20℃) (min)	Spray Range (m)

Determine the flow, spray range, foaming multiples and 25% drainage time in accordance with regulations in **5.12**, **5.13**, and **5.16** respectively.

4.3.2 Mixing Ratio of Foam Intermixture
Foam-mixer of the fire truck, after mixing the primary foam solution with water, can produce the foam intermixture of 3%-4% or 6%-7%.
Determine the mixing ratio in accordance with regulations in **5.15**.

4.4 Performance Requirements of Powder Spray System

4.4.1 Dry Powder Tank
Design, manufacture and check the dry powder tank in accordance with *Safety –supervision Regulation of Pressure Vessel* and regulations in GB 150.

4.4.2 Spray System of Powder Truck
The performance requirements of the spray system for the dry powder truck should meet the regulations in Table 7. Conduct the test in accordance with the regulations in **5.17**.

Table 7: Performance of Spray System for Powder Truck

Rated Fill Weight of Dry Powder (kg)	Maximum Operating Pressure of Powder Tank (kPa)	Minimum Operating Pressure of Powder Tank (kPa)	Air-charging Time (s)	Residual Powder Rate %	Powder Monitor	
					Effective Spray Rate (kg/s)	Effective Spray Range (m)

4.4.3 Dry Powder truck must be equipped with dry-powder-compatible fire hose reel of no less than 30m long, whose performance should meet the regulations in GB 15090.

4.5 Requirements on Stability, Strength, Operation, Safety and Fire Performance

4.5.1 Stability

4.5.1.1 There should be adequate safety margin for the stability of the elevating fire truck. The elevating fire truck is required to be loaded with 1.1 times rated load. Under the worst stability condition and within the safe operation area, the total of the residual load of the two landing legs after deducting the load [sic] should be larger than 10% of the rear-axis mass at curb mass, which can be expressed as follows:
$F_e > 0.1\ GOK$ (1)

In above equation:
F_e**:** total volume of the residual load
GOK: rear-axle-load mass at curb mass of the elevating fire truck (kg)

4.5.1.2 For the elevating fire truck of various regulations, total volume of the residual load should be no less than the limit value regulated in Table 8.

Table 8: Limit Value of Total Volume of the Residual Load

Rated Height for Elevating Fire Truck (m)			Total Volume of the Residual Load (kg)
Platform Truck	Water Tower Fire Truck	Aerial Ladder Truck	

4.5.1.3 Conduct the measurement in accordance with the methods regulated in **5.18**.

4.5.2 Strength of Ladder Frame and Arm frame

Load the platform truck and the aerial ladder truck with1.5 times rated load, check and measure the strength of the arm frame and ladder frame. Within the safe operation area and under different operation conditions, no permanent deformation and crack shall be spotted on the arm and ladder frame. Conduct the operation in accordance with the requirements regulated in **4.5.3**.

After the stability test, the water tower fire truck should be able to complete all operations stipulated in 4.5.3 successfully.

The strength test should be carried out in accordance with the methods stipulated in **5.19**.

4.5.3 Operation Performance

4.5.3.1 Time for leg-expansion of the elevating fire truck: no more than 30s for the light-duty and medium-duty elevating fire truck; no more than 40s for the heavy elevating fire truck.

4.5.3.2 Lift the arm frame or the ladder frame from the bracket, and hoist them to the rated operating height and rotate by 90°. The total time needed for the above operations should be no more than the values stipulated as follows:

a. 150s for the light-duty and medium-duty platform fire truck; 200s for the heavy-duty platform fire truck
b. 150s for the light-duty and medium-duty water tower fire truck; 140s for the heavy-duty water tower fire truck.
c. 90s for the light-duty and medium-duty ladder fire truck; 120s for the heavy-duty ladder fire truck.

4.5.3.3 In the above state, the arm frame or the ladder frame should be capable of rotating by 360° to both the left and right direction respectively.

4.5.3.4 Put the arm frame or the ladder frame back into the bracket with the sequence contrary to that in **4.5.3.2**. Time for such step should be no more than the regulated value in **4.5.3.2**.

4.5.3.5 Conduct the test of operation performance in accordance with the methods regulated in **5.20**.

4.5.4 Operation Safety Performance

4.5.4.1 Arm frame or ladder frame of the elevating fire truck should be able to operate stably and smoothly.
No as abnormalities such as oil-leakage, vibration, moving should be spotted in the hydraulic system.

4.5.4.2 The electric system of the elevating fire truck should be normal and reliable for operation.

4.5.4.3 The elevating fire truck should be capable of either automatically or manually leveling the rotating table or ladder stair.

When the self-leveling device is adopted, the leveling accuracy of the separation angle between the rotating table or ladder stair and the horizontal surface should be no bigger than 1.5°. If the separation angle is larger than 1.5°, red signal light should be on; if the separation angle is or less than 1.5°, green signal light should be on.

If manually leveled, indicator should be installed at a conspicuous place for operators. Such indicator shall be able to indicate the safe operation area where the separation angle between the rotating table or the ladder stair and the horizontal surface is no larger than 1.5°.

4.5.4.4 When the rangeability of the platform fire truck and the water tower fire truck is at the limit value as well as the telescopic jib at the rated maximum operation range, it should be

automatically stopped.

4.5.4.5 When the ladder frame is at the limit position within the safe operation area, it should be able to automatically stop the expansion action of the ladder frame and the reduction of the elevation angle.

4.5.4.6 Within the operation area of the elevating fire truck, keep the upper-surface of the manned platform horizontal.

4.5.4.7 Before the leg-expansion and leveling of the elevating fire truck, never move the arm frame or the ladder frame;
Before retracting the arm frame or the ladder frame, never retract its landing legs. The interlocking between said landing legs and the arm frame or the ladder frame can be automatically switched over; the lockup device should be installed in the operating handle if manual operation is selected.

4.5.4.8 At the time of the start-up of the arm frame or ladder frame of the elevating fire truck, its safety system should be automatically started.

4.5.4.9 Actions by arm frame and ladder frame should be automatically stopped at the time that the manned platform of the platform truck and the top ladder of the aerial ladder truck encountered obstacles.

4.5.4.10 In the operation process, alarm signal that any landing leg of the arm frame or ladder frame of the elevating fire truck is force-unbearable.

4.5.1.11 Mark of safe operation area for the arm frame or ladder frame should be labeled at a conspicuous operation place of the elevating fire truck.

4.5.1.12 In the event of failure of power-supply or hydraulic system, no such problems as fall of arm frame or ladder frame, glide of the telescopic jib and retraction of the landing legs should occur. In the event of any breakage of single steel cable of the aerial ladder truck, the gliding distance for each stair of the ladder frame should not exceed that of one stair-step, and for the elevator scoop not exceed 1m.

4.5.1.13 Emergency auxiliary device should be installed in the elevating fire truck, and such device should be capable of retracting the arm frame or ladder frame in the event of any failure.

4.5.1.14 See **5.21** for the test methods of operation safety performance.

4.5.5 Fire Performance
Water-jet should be installed in the elevating fire truck, and its performance should be compliant with the regulations of **4.2.8** and **4.3.1.**

5 Test Methods
5.1 Preparation before Test
Conduct the preparation work in accordance with regulations in GB/T 12534.

5.2 Measuring Methods for Main Structure Parameters and Quality Parameters

5.2.1 Measure the curb mass of the fire truck, the front/rear axle-load mass at curb mass, the front/rear axle –load mass at curb mass and maximum total mass according to the regulations in GB/T 12674.

Determine the horizontal position and height of the centroid of the complete vehicle according to the regulations in GB/T 12538 (Attention: when determining the height of the centroid, one should take necessary measurements to prevent the extinguishant from pouring out).

The measured value of the front/rear axle-load mass at maximum total mass should comply with the regulations in **4.1.2.4**.

5.2.2 The extinguishant mass can be obtained by first deducting the curb mass of the fire truck from its maximum total mass, then further deducting the mass of the passengers. The final result should be in line with the regulated value in Table 1.

5.2.3 Measure the external dimension, approach angle and departure angle in accordance with the regulations in GB/T 12673, and the measured results should be in line with the regulation in **4.1.2.1** and **4.1.2.2**.

5.2.4 Measure the rated operating height of the elevating fire truck by directly using the steel tape or indirectly using the heavy bob for Suspension. The measured value should be in line with the regulated value in Table 2.

5.3 Test Methods for Acceleration Performance and Maximum Vehicle Speed
Conduct the test in accordance with the regulations in GB/T 12543 and GB/T 12544, and the measured results should meet the requirements of **4.1.3**.

5.4 Test Methods for Braking Performance
Conduct the test of service braking performance and parking braking performance in accordance with the regulations in GB 7258, and the measured results should meet the requirements of **4.1.4**.

5.5 Test Methods for Rainproof Performance

5.5.1 Close each door and window of the fire truck, and park it for 15 minutes in the medium or heavy rain (the engine operates at idled speed). Then drive the fire truck to the shelter, check and take photo of the driver's cabin, passenger's cabin and equipment box. The test results should be in line with the requirement of **4.1.5**.

5.5.2 Artificial rain is recommended in substitution for the methods stipulated in 5.5.1. If so, precipitation intensity should be no more than 0.12mm/s, time for raining the fire truck should be 15 minutes, and other items should be in line with the regulations in **5.5.1**.

5.5.3 Determine the precipitation intensity using the rain gauge simultaneously in the test.

5.6 Test Methods for Reliability
Conduct the test of reliability in accordance with the regulations in GB/T 12678.
Select the road and distribute the mileage in accordance with the regulations in Table 9.

Table 9: Road Types and Mileage Distribution

Road Types	Driving Mileages (km)
Uneven Macadam, Stone Block Road and Earth-stone Road	1 500
Mountainous Road	1 500
Plat-road of Asphalt and Cement	2 000

Record and make statistic of the driving mileage, average technical speed, average fuel-consumption, lubricant-consumption, number of failure times, maintenance and repair conditions, then analyze such failures. When finished the test, check each system of the fire truck thoroughly. See 4.1.6 for the evaluation of the test results.

5.7 Test Methods for Tightness and Strength of the Outlet-pipeline

5.7.1 Test Methods for Tightness
Fill the outlet-pipeline at the rear part of the fire pump's check-valve with water (in the inlet), and any residual air should be removed. Close all the valves in the inlet, apply pressure to the internal part of pipeline using the hydraulic test pump, and keep it for 3 minutes until the regulated value reached, and then discharge the pressure, and check it in accordance with requirements in **4.2.3.1**.

5.7.2 Test Methods for Strength
Fill water into such pressure-bearing parts as outlet-pipeline, and no residual air should be kept in it. Apply the pressure gradually to the hydraulic test pump until the regulated value achieved, and kept it for 3 minutes and then discharge the pressure. Check it in accordance with the requirements of 4.**2.3.2**.

5.8 Test Methods for Vacuum Degree and Tightness of the Priming Device

5.8.1 Enclose with a cap one end of the suction water pipe (of regulated length) installed in the fire truck, connect the other end to a water-inlet of the fire truck, and close all other water-inlets. Make sure any residual water is removed from the suction pipe of the pump. Start the priming device until the maximum vacuum degree, and record the value after stable operation. Such value should be in line with the regulations in **4.2.4**.

5.8.2 Close the priming device when the maximum vacuum degree reached, measure the reduced value of the vacuum degree within 1 minute, and such value should be in line with the regulations in **4.2.4**.

5.8.3 The test condition should be standard atmosphere, if not, then modify the vacuum degree in accordance with the regulations in GB 6245.

5.9 Test Methods for Performance, Priming Time and Reliability of Pump at Maximum Suction Depth

5.9.1 Connect one end of the suction water pipe of fire truck to the water-inlet of the fire pump, connect the other end of the suction water pipe to the water-filter, and throw it into the water pool or other water source to make the suction depth at 7m (fully sink the water-filter). Start the priming device. Measure the time from the moment the priming device starts working to the moment the pressure is displayed on the delivery gauge of the fire pump. The results should be in

line with the regulations on priming time in **4.2.5.3**.

4.2.5.3 Regulations on Priming Time

5.9.2 Following said test, drain the water, and repeat the priming time test for 2 times. For the three tests, the results should be in line with the regulations in **4.2.5.3**.

5.9.3 Following said test, continue the test of pump performance at the maximum suction depth. The test results should be in line with the regulations in **4.2.5.2**.

5.9.4 If the test condition is not the standard atmosphere, modify the suction depth in accordance with the regulations in GB 6245.

5.9.5 In the event that the rated operation condition can be achieved only when two water-inlets of the fire truck are operating simultaneously, install the water-inlet pipeline in the two water-inlets to conduct the test.

In the case with special-designed device, finish the priming action on one in-let first, and such time is deemed as the priming time. But only when the other water-inlet can automatically finish the priming action during the water-supply process, it can be deemed that the test is passed.

5.10 Test Methods for Continuous Operation Time

5.10.1 Test Conditions

5.10.1.1 Connect the fire truck to the suction water pipe attached with water-filter, throw it into the water pool or other water source for 3m of suction depth (fully immerse the water-filter). If two water suction pipes are needed for priming, connect such two suction pipes to the fire truck. Install the hydraulic-giant with lined water band (when the hydraulic-giant flow-meter is used for measurement, use the standard hydraulic-giant for substitution). The numbers and caliber of the hydraulic-giants should be determined based on the flow of the pump. Pressure-bearing hose can be used for measurement of the medium and high pressure.

5.10.1.2 Measure the outlet pressure with pressure gauge; measure the flow with hydraulic-giant flow-gauge; measure the temperature with the mercury thermometer, semiconductor thermometer and other measuring device; measure the rotation speed with the speed indicator or other rotation indicator.

5.10.2 Test Operation

5.10.2.1 Start the fire pump, adjust the rotation speed and openness of the water-outlet valves of the pump, making the discharge pressure and flow achieve the regulated value in **4.2.9**, and count the time after steady operation. Then conduct the test in accordance with the contents and sequences of **4.2.6**, measure the regulated parameters every 5 minutes, and record the value. Conduct the test without any pause, and maintain the discharge pressure and flow of the pump at no less than the regulated value. Adjust the auxiliary cooler any time if necessary, and ensure that the temperatures of the outlet water and vehicle oil are compliant with the regulations in b and c of **4.2.6.3**.

5.10.2.2 Parameters for Measurement in Test
a. Discharge-pressure of pump
b. Flow of pump
c. Rotation-speed of pump
d. Outlet-water temperature of engine
e. Vehicle-oil temperature of engine
f. Lubricant temperature of transmission
g. Lubricant temperature of power output device
h. Axle-bearing temperature of output axle in power output device
i. Atmosphere temperature

5.10.3 Analysis and Determination of the Test Result
Arrange the test data, and draw curves for changes of the discharge pressure and flow of the pump, as well as the temperature of d to h in **5.10.2.2** over time, and determine whether they meet the requirements in **4.2.5**.

5.11 Over-loaded Operation Test
The same test equipments as **5.10.** Start the fire pump, adjust the discharge pressure of the fire pump to 1.1 times the regulated value for the fire truck, keep the flow at the regulated value, and count the time when it operates steadily, and then stop it after 10 minutes. Determine the test results in accordance with the regulations in **4.2.7**.

5.12 Determination the numbers of the Water-monitor and Foam Monitor
Select any one of the measuring methods regulated in **5.12.1**, **5.12.2** and **5.12.3**, and their test results should be no less than the regulated flow. The flow-gauge measuring method will be the method for final determination.

5.12.1 Measuring Tank Method
Select the volume of the measuring tank according to the flow of the monitor, start the fire pump, have the water monitor or the foam-monitor spray (use the foam-monitor in substitution for the previous foam solution). Turn to spray into the measuring tank for 1 minute after the rated spray pressure is reached, then move it immediately to measure the capacity or weight of the water in

the measuring tank, and then calculate the flow of the monitor.

5.12.2 Gravimetric Method

Fill the water tank and foam tank of the fire truck with enough water, weigh the entire truck on the weighbridge or a pachimeter and maintain a record. Start the fire pump, and open the water valve for timing after the pressure at the inlet of fire monitor reaches a rated spray pressure. When the level indicator in the water tank shows that the level has dropped to a 1/5 height, stop the spray and record spray time. Weigh the fire truck again, and the difference between former and latter weights is divided by time interval to get the flow of the monitor. Note that during the spray, the rated value of spray pressure of the monitor must be kept stable.

5.12.3 Measurement by Flow Meter

Use various calibrated flow meters to measure flow directly.

5.13 Determination of Range of Water Monitor and Foam Monitor

5.13.1 Test Conditions

The test place shall be flat, long and wide enough, and the fire truck parked on a proper position, the monitor having an elevation of 30°±20°. By taking the intersecting point between the plumb line passing the monitor mouth and the ground as origin, measure the range in the direction of wind. Hoist the fire truck to a rated height, and measure the range according to the requirements as specified above.

5.13.2 Test operation

For the purpose of the test, wind speed shall be less than 2 m/s. Start up the fire pump, and spray for 30s at a stable elevation after the pressure at the monitor inlet amounts to a rated spray pressure and spray water or foam becomes steady. Using a stopwatch, measure a farthest point where media drops for a minimum of 10s successively. The distance from the point to origin is the range of the monitor that shall comply with **4.2.8** and **4.3.1**.

5.14 Measurement of Fire Truck Pressure and Flow

5.14.1 Test conditions shall be in accordance with **5.10.1**.

5.14.2 Test Operation

Start up the fire truck, and adjust rotation speed of the pump and openness of outlet valve, making fire truck pressure and flow reach the values specified in **4.2.9**. After steady operation, read the values of pressure and flow.

5.15 Measurement of Mixing Ratio

Based on such a characteristic that foam intermixtures of different concentration has a different refractive index, measure the mixing ratio using a refraction meter.

First prepare a calibration curve, with a burette, take out foam liquid from the foam tank of the fire

truck, and drip 3mL, 6mL and 9mL into three 100mL measuring cylinders respectively; add water from the water tank to each measuring cylinder to 100mL, and after complete mixing, prepare foam intermixture with the standard concentrations of 3%, 6% and 9%. Read the graduations on the refraction meter, and on a squared paper, plot a calibration curve of the graduations on the refraction meter vs. concentrations of foam intermixtures.

Use the foam intermixture as sample, which is separated out when carrying out the drainage time test in 5.16. Read the graduations on the refraction meter, and find out the mixing ratio of the sample on the calibration curve.

The obtained mixing ratio shall comply with **4.3.2**.

5.16 Measurement of Foaming Multiple and 25% Drainage Time

5.16.1 Special Test Facility

In terms of structure and size, the foam collector and foam drainage tester shall conform to the requirements in Fig.4 “Schematic drawing of a low-multiple foam collector” and Fig. 5 “Schematic drawing of a low-multiple foam drainage tester” in **5.6.1.1** of GB 15308－94.

5.16.2 Test method

5.16.2.1 Sampling method

Put the foam collector and foam drainage tester near the center of estimated fall range. First, have the foam monitor to spray to other directions, and turn it to the foam collector after rated spray pressure is reached and gets stable. When foam flows into the foam drainage tester, count the time that is used as the starting time for the drainage time test. After the tester is full of foam, stop spray, remove excessive foam from the top using a doctor blade, and wipe clean the surface, completing the sampling.

5.16.2.2 Measurement of Foaming Multiple

Weigh the mass of the drainage tester full of foam, and calculate foaming multiple using formula (2):

$$N = \frac{V_e \cdot d - (W_e - W)}{W_e - W} \quad \cdots\cdots (2)$$

Where, N—— foaming multiple;

Ve—— volume of foam drainage tester, cm3;

We—— total mass of the drainage tester full of foam, g;

We——mass of the drainage tester. g;

d—— density of intermixture, getting d＝1 g/cm3.

Get the arithmetic mean of test results of two samples.

5.16.2.3 Measurement of 25% drainage time

After removing the drainage collecting tank under the foam drainage tester, put it on a platform balance, and put the foam collecting tank on the bracket. Note to fill liquid separated into the drainage collecting tank. When the mass of separated liquid is 25% of drainage mass, stop the timing, and record the 25% drainage time. Get the arithmetic mean of test results of two samples. Calculate 25% drainage mass using formula (3).

$$f = \frac{W_e - W}{W_e - W} \times 4 \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (3)$$

Where, Wf—— 25% drainage mass, g.

5.16.2.4 Correction of test temperature influence

The temperature of water in foam intermixture has a greater influence on foaming multiple and drainage time. Therefore, during the test, the water temperature shall be controlled within 15-25 ℃.

Protein foam extinguishant shall be corrected as follows:

Foaming multiple ---- when the temperature of water in foam intermixture exceeds 20 ℃, foaming multiple is reduced by 0.1 when the temperature increases by 1.7 ℃; when the temperature of water in foam intermixture is below 20 ℃, foaming multiple is increas

temperature reduces by 1.7 ℃.

Drainage time ---- when the temperature of water in foam intermixture exceeds 20 ℃, drainage time is increased by 0.1 min when the temperature increases by 1.7 ℃. When the temperature of water in foam intermixture is below 20 ℃, drainage time is reduced by 0.1 min when the temperature reduces by 1.7 ℃.

5.16.3 Judgment of Results
Judgment is to be carried out according to Table 6.

5.17 Performance Determination of Spray System of Dry Powder Truck

5.17.1 Test conditions

5.17.1.1 The test place shall be flat, long and wide enough, with wind speed at less than 2m/s and temperature falling within 0-30 ℃.

5.17.1.2 Load dry powder of rated fill weight into the dry powder tank, and keep it stand for at least 12h. Before the test, the fire truck shall drive a course of at least 30km.

5.17.2 Field layout
Park the dry powder truck in a proper position. Take the intersecting point between the plumb line passing the horizontal dry powder monitor mouth and the ground as origin; deploy a powder receiving trays in the direction down the wind, place a tray every 2m within 60-150% of the range, and the powder receiving trays shall be in line with the origins; deploy three parallel lines respectively on the right and left of the connecting line, the space between two lines being 2m. Gridding with mutually perpendicular pattern shall be deployed.
The powder receiving trays shall be square, having identical specifications. The side may be 300 - 400mm and height 30 - 40mm.

5.17.3 Determination of Charging Time

Start the charging system to fill air into the dry powder tank, and begin timing. The time when the pressure in the tank reaches the designed maximum working pressure is charging time.

5.17.4 Determination of Effective Range

After the dry powder tank is pressurized to the specified maximum working pressure for 30s, have the dry powder monitor to spray dry powder horizontally and begin timing. When the pressure in the tank reaches the designed minimum working pressure, stop discharging, and the time interval is effective spray time.

Weigh the mass of dry powder in each powder receiving tray, obtain the sum of masses of dry powder in seven powder receiving trays in each row, and plot a curve of powder received in each row vs. distance to the origin. Effective range means the distance from the row with maximum mass to the origin.

5.17.5 Determination of Residual Powder Rate

Drain out the residual air in the dry powder tank through the exhaust pipe, take out and weigh the dry powder. Calculate residual powder rate according to **3.28**.

5.17.6 Determination of Spray Rate

Calculate effective rate in the formula (4):

$$E = \frac{Q_0 - Q_e}{T} \quad \text{……} \quad (4)$$

Where ： E—— effective spray rate, kg/s;

Q0—— fill weight of dry powder, kg;

Qe—— mass of residual dry powder, kg;

T—— effective spray time, s.

5.17.1 Determination of results

Charging time, effective range, residual powder rate and effective spray rate must conform to Table 7.

5.18 Measuring method for stability of elevating fire truck

5.18.1 Test Conditions

The test place shall be flat, hard and spacious enough for the spread and operation of elevating fire truck. Carry out the test when wind speed is less than 2m/s.

5.18.2 Test Method

5.18.2.1 Vertical stability

Spread the two landing legs at the front of the elevating fire truck, and support it on a pachimeter, or on a position near the center of the weighbridge, with the connecting line of the two standing legs to be parallel to the central line of the weighbridge table board. Spread the two back standing legs and have them stand on the ground. Keep the front and rear wheels of the elevating fire truck off the ground, level them, and add 1.1 times rated load.

Slowly elevate and rotate the arm frame or ladder frame of the platform truck or aerial ladder truck. When stability is at the worst working status (i.e. working status where load value is minimum) within a safe operation area, record the loading value indicated on the patchimeter or weighbridge.

When a water tower fire truck is at the worst stability within a safe operation area, the spray monitor sprays water at 1.1 times rated spray pressure. Record the loading value indicated on the patchimeter or weighbridge.

5.18.2.2 Horizontal stability

Spread the two landing legs on the left or right of the elevating fire truck, and support it on a pachimeter, or on a position near the center of the weighbridge, with the connecting line of the two standing legs to be parallel to the central line of the weighbridge table board. Spread the other two standing legs on the ground and keep off the ground the front and rear wheels of the elevating fire truck. Other procedures are the same as **5.18.2.1**.

5.18.3 Judgment of Results
From the measured values in **5.18.2.1** and **5.18.2.2**, select a smaller one as Fe, the sum of residual load in **4.5.1.1**, but it must comply with the formula (1) in **4.5.1.1** and not be less than a specified value in Table 8.

5.19 Strength test of ladder frame and arm frame

5.19.1 Test conditions
The same as in **5.18.1**.

5.19.2 Test method
On the test place, spread the landing legs, level them, and add 1.5 times rated load. Along a longitudinal symmetrical plane of the elevating truck, raise the arm frame or ladder frame, and keep them for 10min at the two working conditions, namely, maximum elongation and rated working height. Retract the arm frame or ladder frame, and remove the applied load.

5.19.3 Judgment of Results.
Judge results according to **4.5.2**.

5.20 Performance test of elevating fire truck operation

5.20.1 Test Conditions
The same as in **5.18.1**.

5.20.2 Test Method

5.20.2.1 After the elevating fire truck is parked steadily, spread the standing legs, and measure the time period from starting action to the foot's touching the ground, which shall comply with **4.5.3.1**.

5.20.2.2 After leveling the elevating fire truck, start time-count from elevation of the arm frame or ladder frame's bracket. Raise and extend it to a working height, rotate 90°, and record the time required, which shall comply with **4.5.3.2**.

5.20.2.3 Under the above working conditions, rotate the arm frame or ladder frame at 360° respectively, and according to a sequence contrary to that in **5.20.2.2**, retract the arm frame or ladder frame to the bracket. Record the time required for retraction, which shall comply with **4.5.3.2**.

5.21 Performance Test of Elevating Fire Truck Use Safety

5.21.1 Test Conditions
The same as in **5.18.1**.

5.21.2 Test Method

5.21.2.1 Using site operation and visual inspection, test each item in **4.5.4.1** - **4.5.4.11**, and all requirements specified shall be met.

5.21.2.2 With respect to the performance requirement in **4.5.4.12**, conduct the judgment by examination of the arm frame or ladder frame, hydraulic latching valves, cable strength and slide lock mechanism of the lift bucket.

5.21.2.3 Spread the elevating fire truck to any working position, and the arm frame or ladder frame shall be retracted by using an auxiliary device, and the result to meet the requirement in **4.5.4.13**.

5.22 Measurement of Equipment Accuracy
Any testing equipment can be used if their metric and measuring errors fall within the range specified in Table 10.

Table 10 Allowable errors of measuring equipment

Physical Quantity for Measurement	Allowable Error		Physical Quantity for Measurement	Allowable Error
Mass			Temperature	
Length			Pressure	
Angle			Flow	
Time			Rotational Speed	

±0.1％ ±1 ℃
±1％ ±2.5％
±20′ ±2.5％
±0.1 s ±1％