English Translation Version for Reference Only

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China Civil Aviation Technical Standard Order

This China Civil Aviation Technical Standard Order (CTSO) is issued according to Part 37 of the China Civil Aviation Regulations （CCAR-37）. Each CTSO is a criterion which the concerned aeronautical materials, parts or appliances used on civil aircraft must comply with when it is presented for airworthiness certification.

Aircraft Halocarbon Clean Agent Hand-Held Fire Extinguisher

1. Purpose

This China Civil Aviation Technical Standard Order (CTSO) is for manufacturers of aircraft halocarbon clean agent hand-held fire extinguishers applying for a CTSO authorization (CTSOA). This CTSO prescribes the minimum performance standards (MPS) that aircraft halocarbon clean agent hand-held fire extinguisher must first meet for approval and use the applicable CTSO mark for identification.

2. Applicability

This CTSO affects new application submitted after its effective date. Major design changes to article approved under this CTSO will require a new authorization in accordance with section 21.353 of CCAR-21R4.

3. Requirements

a. Aircraft hand-held halocarbon fire extinguishers manufactured and intended to be identified by using these CTSO's marks on or after the effective date of this CTSO must meet the minimum performance standards in the Appendix 1 of this document.

b. Classification and rating of fire extinguishers prescribed in this document.

(1) Rating-Class 8B

The performance and structural requirements of fire extinguishers shall meet Rating-Class 8B of GB4351.1, in addition, the minimum effective discharge time shall be at least 8 seconds.

For small aircrafts, you may use this Rating-Class 8B extinguishers or the equivalent.

(2) Rating-Class 13B

The performance and structural requirements of fire extinguishers shall meet Rating-Class 13B of GB4351.1, in addition, the minimum effective discharge time shall be at least 8 seconds.

For small aircrafts, you may use this Rating-Class 13B extinguishers or the equivalent.

(3) Rating-Class 21B

The performance and structural requirements of fire extinguishers

shall meet Rating-Class 21B of GB4351.1.

For small aircrafts, you may use this Rating-Class 21B extinguishers or the equivalent.

(4) Rating-Class 34B

The performance and structural requirements of fire extinguishers shall meet Rating-Class 34B of GB4351.1.

For the transport category aircrafts, you may use this Rating-Class 34B extinguishers or the equivalent in the cabin and flight deck compartments.

(5) Rating-Class 55B

The performance and structural requirements of fire extinguishers shall meet Rating-Class 55B of GB4351.1.

For the transport category aircrafts, you may use this Rating-Class 55B extinguishers or the equivalent in the cargo compartments.

c. Functionality

This CTSO's standards apply to the aircraft halocarbon clean agent hand-held fire extinguisher for use on fires in the aircraft. These units are intended to combat fires caused by combustible materials like paper, textiles, etc. These units are also suitable for extinguishing seats and electrical equipment fires. These units may be used to control fires involving initial fire of a small number of rechargeable lithium batteries.

d. Deviations

For using alternative or equivalent means of compliance to the criteria in the MPS of this CTSO, the applicant must demonstrate that the equipment maintains an equivalent level of safety. The applicant must apply for a deviation approval in accordance with section 21.368(a) of CCAR-21-R4.

4. Marking

a. For each unit, mark at least one major component permanently and legibly with all the information required in section 21.423 (b) of CCAR-21R4.

b. Also, the permanent and legible markings shall include the following information.

(1) There shall be luminous signs on the fire extinguisher body to indicate the location of the fire extinguisher in the dark. Luminous signs shall be made of non-toxic, non-radioactive materials or other materials harmless for the human body.

(2) Name and model of the fire extinguisher, the type of fire extinguishing agent.

(3) Class of Fire (see Figure 1), the use-code symbols shall have dimensions no less than 16 mm × 16 mm and no more than 32 mm × 32 mm, excluding the borders.

Note：For those classes of fires for which the extinguisher is not

intended for use, the use-code may not be marked. For those classes of fires for which the extinguisher is not intended for use because of potential injury to the operator, the use-code symbols with a red "×" and annotated words shall also be placed on the nameplate of the fire extinguisher.

(4) Operating temperature range of fire extinguisher.

(5) Weight (kg) of extinguishing agent and the gross weight (kg) of the fire extinguisher.

(6) Name, pressure (or quantity) of the driving gas.

(7) Hydrostatic pressure of fire extinguisher (shall be stamped in the bottom, collar or other place of the fire extinguisher body where not subject to internal pressure).

(8) Approved certification of fire extinguisher.

(9) Manufacture serial number of the fire extinguisher (can be printed on the nameplate, or can also be engraved on the bottom of the fire extinguisher).

(10) Manufacture date of the fire extinguisher.

(11) Name or code of the fire extinguisher manufacturer.

(12) The operating instructions shall be in the form of one or more pictographs and the class codes of fire (see Figure 1).The operating instructions shall be placed in obvious position and covered no more than a 120° arc on the extinguisher body. The marking shall occupy a

minimum surface area of 75.0 cm^2 for an extinguisher having a diameter greater than 80.0 mm and 50.0 cm^2 for an extinguisher having a diameter of 80.0 mm or less.

(13) Recharge instructions and routine maintenance instructions.

Class A

Ordinary solid material fires

Class B

Flammable liquid fires

Class C

Gas and vapor fires

Class E

Fire involving energized electrical conductors

Figure 1 Use-code symbols

5. Application Data Requirements

The applicant must furnish the responsible certification personnel

with the related data to support design and production approval. The application data include a statement of conformance as specified in section 21.353 (a) of CCAR-21R4 and one copy each of the following technical data:

a. Operating instructions and equipment limitations, sufficient to describe the equipment's operational capability. Describe any deviations in detail. If needed, identify equipment by part number, version, revision, and criticality level of software/hardware, classification for use, and environmental categories.

b. Installation procedures and limitations, sufficient to ensure that the aircraft hand-held fire extinguisher, when installed according to the installation procedures, still meets this CTSO's requirements. Limitations must identify any unique aspects of the installation. Finally, the limitations must include a note with the following statements:

"This article meets the minimum performance standards and quality control standards required by a CTSO. Installation of this article requires separate approval."

c. List of components, by part number, that make up the aircraft hand-held fire extinguisher complying with the standards prescribed under this CTSO. Include vendor part number cross-references, when applicable.

d. Marking drawing with the information required by paragraph 4 of

this CTSO.

e. Technical conditions, design specification and process documents, etc.

f. List of all drawings and processes (including revision level) that define the article's design.

g. A component maintenance manual (CMM), covering periodic maintenance, calibration, and repair, for the continued airworthiness of installed aircraft hand-held fire extinguisher assembly, Include recommended inspection intervals and service life, as appropriate.

h. The quality control system (QCS) description required by 21.358 of CCAR-21R4, including functional test specifications. The QCS should ensure that you will detect any change to the equipment that could adversely affect compliance with the CTSO MPS, and reject the item accordingly.

i. Manufacturer's CTSO qualification test report showing results of testing accomplished according to paragraph 3 of this CTSO.

j. Provide any other appropriate documents required by the authorities.

6. Manufacturer Data Requirements

Besides the data given directly to the authorities, have the following technical data available for review by the authorities:

a. Functional qualification specifications for qualifying each production article to ensure compliance with this CTSO.

b. Material and process specifications.

7. Furnished Data Requirements

If furnishing one or more articles manufactured under this CTSO to one entity (such as an operator or repair station), provide one copy of the technical data in paragraph 5.a, 5.b, 5.c and 5.g of this CTSO. Add any other data needed for the proper installation, certification, use, or for continued airworthiness, of the aircraft halocarbon clean agent hand-held fire extinguisher.

8. Availability of Referenced Documents.

Order National Standards (GB) from: China Zhijian Publishing House (Standards Press of China), Hepingli West Street 2, Chaoyang District, Beijing, China. You may also order them online from the GB Internet website at: www.spc.net.cn.

Order National Environmental Protection Standards (HJ/T) from: China Environmental Publishing Group, No 16, Guangqumen Street, Dong cheng District, Beijing, China. You may also order them online from the Internet website at: http://www.cesp.com.cn.

Appendix 1. Minimum Performance Standards for Aircraft Halocarbon Clean Agent Hand-Held Fire Extinguisher

1. Purpose

Minimum performance standards (MPS) for the aircraft hand-held fire extinguisher which use halocarbon clean agent, to be identified as meeting the standards of CTSO-2C602.

2. Scope

Minimum performance standards apply to halocarbon clean agent performance. These standards are also for the fire extinguisher performance and structural requirements which have been tested.

3. Extinguishing Agent Performance Requirements

3.1 Environmental Requirements

3.1.1 Effects on the Atmospheric Ozone Layer

The Ozone Depletion Potential（ODP）of fire extinguishing agent should meet the requirements of HJ/T 225-2005《Technical requirement for environmental labeling products ODS substitute》,ODP≤0.11, and the smaller the better.

3.1.2 Greenhouse Effect

Non-greenhouse or low greenhouse effect, Global Warming Potential (GWP) should less than 1.0.

3.2 Toxicity Requirements

3.2.1 Oral Median Lethal Dose (LD50)

The oral median lethal dose of fire extinguishing agent is tested according to GB/T 21603-2008《Chemicals-Test method of acute oral toxicity》, the toxicity test results should not exceed the medium toxicity grade.

3.2.2 Median Lethal Concentration (LC50)

The median lethal concentration of fire extinguishing agent is tested according to GB/T 21605-2008《Test method of acute inhalation toxicity for chemicals》, the toxicity test results should not exceed the low toxicity grade.

3.2.3 Dermal Median Lethal Dose (LD50)

The dermal median lethal dose of fire extinguishing agent is tested according to GB/T 21606-2008《Test method of acute dermal toxicity for chemicals》, the toxicity test results should not exceed the low toxicity grade.

3.3 Hidden Fire Test

Technical specifications and test methods conform to Appendix 2.

3.4 Seat Fire/Toxicology Test

Technical specifications and test methods conform to Appendix 3.

4. Performance and Structural Requirements

The extinguishers are tested and judged according to GB 4351.1-2005《Portable fire extinguishers-Part 1：Performance and construction》.The fuel used in the "7.3 Class B rated extinguishers" show

as Table 1.

Table 1. n-Heptane Specifications

Density（20℃），g/cm³	0.6833-0.6841
Refraction coefficient	1.3877-1.3879
Appearance	Colorless, No residue, Transparent liquid

Appendix 2. Hidden Fire Test

1. Purpose

The test evaluates the "flooding" characteristics of the halocarbon clean agent against a hidden in-flight fire and determines the ability of a streaming agent to function as a flooding agent.

2. Test Apparatus

2.1 Test Appliance

The extinguisher must meet Rating-Class 34B of GB 4351.1.

2.2 Hidden Fire Test Chamber

The hidden fire test chamber is conducted in a rectangular box 2 meters high, 0.5 meter wide, and 2 meters long. One long side of the box is fitted with clear glasses to allow an unobstructed view of the interior (Figure 2.1). The interior of the box is fitted with 20 metal cups, 35 millimeters in diameter (Figure 2.2), arranged in three vertical arrays of four cups and one vertical array of eight cups (Figure 2.3). The baffles are perforated to allow a 33-percent hole area to separate the arrays, the diameter of these holes is 3 millimeters. Two ventilation ports are cut into the left side of the box, at the top and bottom of the fixture, the size of the ventilation ports is 425mm by 125mm. A hole with diameter of 51 millimeters is cut into the same side, through which the extinguisher agent is introduced (Figure 2.4). Meanwhile, there are two heaters at the bottom of test chamber.

Figure 2.1 Hidden Fire Test Chamber

Figure 2.2 Test Cup

Figure 2.3 Detail of Cup Locations

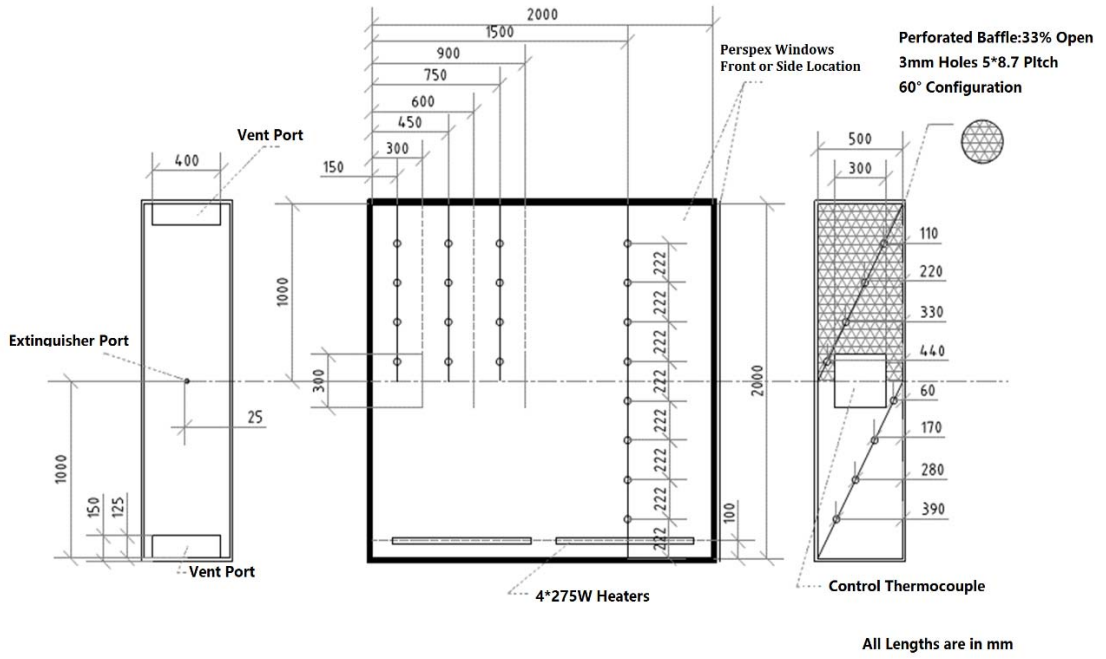

Figure2.4 Hidden Fire Test Apparatus Plans and Dimensions

3. Test Procedure

(1)Before testing, condition the extinguishers to 21℃-32℃ for 24h minimum.

(2) Before testing, the test chamber and the extinguishers are to be equilibrated at a temperature of 21℃-32℃, heat the test chamber with heaters when temperature is low. If successive tests are to be run, the test fixture must be allowed to cool to the prescribed temperature.

(3) Weighed and recorded the weight of extinguisher.

(4) The 20 cups are loaded with 10 milliliters of water and 5 milliliters of n-heptane.

(5) The loaded extinguisher is mounted on the left side of the test

chamber such that the nozzle is directed through the 51 millimeters hole in the left side of the test chamber. Care must be taken with the nozzle orientation to insure that the discharge stream is level and centered left to right through the discharge port.

(6) The 20 cups are ignited in 15 seconds, the access doors are closed at this time. A preburn of 30 seconds is timed from the closing of the access doors. The extinguisher is discharged fully at the end of the 30 second preburn. A stopwatch is used to measure the discharge time.

(7) The number of fires extinguished up to 60 seconds after discharge is recorded.

(8) Weighed and recorded the weight of extinguisher.

(9) After recording, the access doors are to be opened to vent the test chamber and any remaining fires are extinguished. The temperature in the box is allowed to return to 21℃-32℃. The remaining contents of the cups are emptied and the cups are cleaned to remove any residue, then start the next test.

4. Requirements

The extinguisher must extinguish a minimum of nine cup-fires when averaged over the five tests.

Appendix 3. Seat Fire/Toxicology Test

1. Purpose

This test is a baseline test that evaluates the effectiveness of halocarbon clean agent in fighting flammable liquid fires and the associated toxicity hazard of the decomposition products of that agent.

2. Test Apparatus

2.1 Test Appliance

The extinguisher must meet Rating-Class 34B of GB 4351.1.

2.2 Test Facility

（1）Simulation fuselage

The size of the testing simulation fuselage is 10.0 meters long, 5.7 meters wide, 2.4 meters high. The fuselage is fitted with an adjustable ventilation system to provide a range of air exchanges within the cabin. For the purposes of this test, the air exchange rate was set one exchange every 5 minutes or equivalent, simulating an in-flight condition.

（2）Instrumentation

The cabin was fitted with three stations where the environmental gases were sampled for analysis. At each station, the concentration levels of oxygen, carbon dioxide, carbon monoxide, and neat agent were monitored continuously using infrared type analyzers. In addition, sample tubes were sequentially exposed to track the buildup of acid gases (primarily HF), measured by the Ion Chromatography method. Cabin air

temperature was measured by three thermocouple trees. The fire severity was measured with a calorimeter (Figure 3.1).

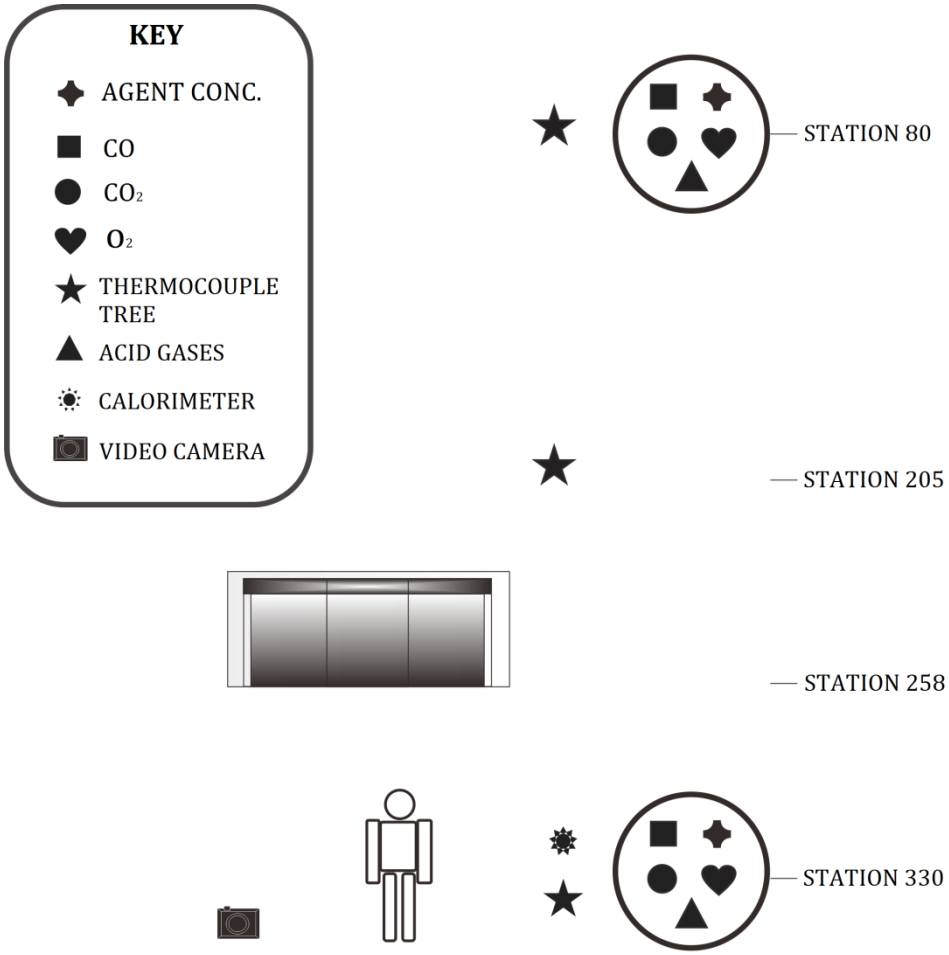

Figure 3.1 the Layout of Seat Fire/Toxicology Test Instrumentation

（3）Fire load

The fire load consisted of a metal frame with three seat bottoms and three seat backs. The seat cushions should be approved. The seat base foam dimensions are 457mm × 508mm × 102mm. The seat back dimensions are 432mm × 635mm × 51mm. The size tolerances are ±2mm.

3. Test Procedure

（1）Condition the extinguishers to 21℃±3℃ for 24h minimum. The extinguisher is to be weighed and recorded before discharging. The extinguisher is fitted with a stopwatch to record the discharge time.

(2) The seat cushions are installed on the metal frames. The center seat base is fitted with a length of nichrome wire stretched across the top of the cushion. The nichrome wire will supply the ignition source.

(3) Cabin ventilation is turned on.

(4) The firefighter, with the extinguisher, is positioned in the cabin, well back from the seat.

(5) The seat is primed with 1.1 liters of automotive gasoline poured across the forward one third of the three seat bases.

(6) The cabin is sealed.

(7) The data systems are started.

(8) The seat is ignited, gas collection and time recorder begins.

(9) The firefighter advances to the burning seat and stands at a mark 1.8 meters from the forward edge of the lower cushion. The firefighter begins to extinguish the fire at exactly 30 seconds from ignition.

(10) Weighed before and after discharge to determine the amount of agent used.

(11) Data and gas collection continue until 10 minutes from the ignition point.

(12) The test is terminated at this time and the cabin is ventilated and

the gas collection cylinders are retrieved for analysis.

4. Requirements

The candidate replacement agent must be capable of extinguishing the seat fire. Hydrogen Fluoride (HF) is the primary hazardous decomposition product. The proposed limits for HF are as follows:

（1）The average concentration of HF shall not exceed 200 ppm for any 60 seconds period.

（2）The average concentration of HF shall not exceed 100 ppm for any 4.5 minutes period.