



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: **HAND FIRE EXTINGUISHERS FOR
USE IN AIRCRAFT**

Date: 8/25/82
Initiated by: AWS-340

AC No: 20-42B
Change:

1. PURPOSE. This advisory circular (AC) provides methods acceptable to the Administrator for showing compliance with the hand fire extinguisher provisions in Parts 25, 29, 91, 121, 125, 127, and 135 of the Federal Aviation Regulations (FAR), and provides related general information.

2. FOCUS. Changes made to some of the FAR requirements for hand fire extinguishers used in aircraft are of utmost concern to both aircraft owners/operators and aviation maintenance agencies. Recent advancement in fire fighting technology and the development of fire extinguishing agents have made it necessary to update the AC information.

3. CANCELLATION. AC 20-42A, Hand Fire Extinguishers for use in Aircraft, dated 7/29/80 is cancelled.

4. RELATED FAR SECTIONS.

- a. FAR 21.305.
- b. FAR 23.561.
- c. FAR 25.561; 25.851.
- d. FAR 27.561.
- e. FAR 29.561; 29.851; FAR 29.853 (e) and (f).
- f. FAR 91.193 (c).
- g. FAR 121.309 (c).
- h. FAR 125.119 (b) and (c)
- i. FAR 127.107 (c).
- j. FAR 135.155.

5. APPROVED HAND FIRE EXTINGUISHERS. Hand fire extinguishers are acceptable under Sections 25.851(a)(1), 29.851(a)(1), 121.309(c), 127.107(c) and 135.155 if they have been approved in accordance with FAR 21, Section 21.305. In accordance with Section 21.305(d) of the FAR the Federal Aviation Administration (FAA) accepts hand fire extinguishers approved by Underwriters

Laboratories, Inc., Factory Mutual Research Corp., or U.S. Coast Guard under CFR 46 for use in aircraft. Although Parts 91 and 125 do not require FAA approval of hand fire extinguishers, the information in this AC is considered acceptable for use by Parts 91 and 125 operators. Operators of nontransport category aircraft should be aware of the disadvantages and precautions listed in section 7 for the different types of fire extinguishers.

6. DISCUSSION.

a. Types of Fires. To properly select an appropriate extinguisher for use in an aircraft, it is recommended that consideration be given to the following classes of fires (as defined in the National Fire Protection Association (NFPA) Standards #10) that are likely to occur:

(1) Class A - Fires in ordinary combustible materials, such as wood, cloth, paper, rubber, and plastics for which the quenching and cooling effects of quantities of water, or of solutions containing a large percentage of water, are of prime importance.

(2) Class B - Fires in flammable liquids, oils, greases, tars, oil base paints, lacquers, and flammable gases, for which extinguishing agents having a blanket effect are essential.

(3) Class C - Fires which involve energized electrical equipment and where the electrical nonconductivity of the extinguishing media is of importance.

(4) Class D - Fires which involve combustible metals, such as magnesium, titanium, zirconium, sodium, lithium, and potassium and require extinguishing agents of the dry powder types, following special techniques and manufacturer's recommendations for use because of the possible chemical reaction between the burning metal and the extinguishing agent.

b. Extinguishing Agents Appropriate for Types of Fires. The following extinguishing agents are recommended as appropriate for use on the types of fires as specified below and defined in paragraph 6a:

- (1) Carbon Dioxide - Class B or C.
- (2) Water - Class A.
- (3) Dry Chemicals - Class A, B, or C.
- (4) Halogenated Hydrocarbons - Class A, B, or C.
- (5) Specialized Dry Powder - Class D.

NOTE: Halogenated Hydrocarbons (Halon 1211) type fire extinguisher of 9 lbs. or larger are rated for Class A type fires. By comparison a water extinguisher of at least 1 1/2 gallons is required to achieve a 1A rating.

NOTE: Only "all purpose" or A, B, C dry chemical powder extinguishers containing monoammonium phosphate have a UL Class A, B, C rating, all other powders have a Class B, C rating only.

c. Location Mounting of Hand Fire Extinguishers in Passenger Compartments.

It is acceptable to install fire extinguishers in passenger compartments according to the following criteria:

(1) In general, locate hand fire extinguishers adjacent to the hazardous area (i.e., galleys, accessible baggage or cargo compartments, electrical equipment racks, etc.) they are intended to protect.

(2) If no clearly defined hazardous area exists, locate the hand fire extinguishers as follows:

(a) When one extinguisher is used, locate it at the flight attendant's station or, where no flight attendant is required, locate the extinguisher at the passenger entrance door.

(b) When two or more extinguishers are used, locate one at each end of the passenger compartment and space the remainder uniformly within the cabin area.

(3) Mount hand fire extinguishers so that they are readily available. If they are not visible in their mounted position, a placard (with letters at least 3/8 inch high) may be used to indicate their location.

(a) Due to the weight of hand fire extinguishers, the aircraft structure and extinguisher mounting brackets should be capable of withstanding the inertia forces shown in Sections 23.561, 25.561, 27.561, and 29.561 of the Federal Aviation Regulations, with the hand fire extinguisher installed.

(b) The weight of the hand fire extinguisher and its mounting bracket should be added to the aircraft empty weight and a new empty weight center of gravity computed.

d. Location and Mounting of Hand Fire Extinguishers in Small Single Engine and Multiengine Aircraft.

(1) Locate hand fire extinguishers so that they are easily accessible to the flight crew and the passengers.

(2) Hand fire extinguishers should not be allowed to lie loose on shelves or seats. Fire extinguishers and mounting brackets should be properly mounted to airframe structure capable of withstanding the inertia forces listed in paragraph c (3)(a) above.

e. Extinguishing Agent Toxicity.

(1) Since the toxicity groupings of various fire extinguishing agents are no longer considered valid comparisons the Underwriters Laboratories, Inc., classification of comparative life hazards of various chemicals has been eliminated.

(2) Fire extinguisher selection should be made with regard to the type fire hazard (Class A, B, C, or D) to be encountered. If extinguishers intended for different classes of fire are grouped, their intended use should be marked conspicuously to aid in the choice of the proper extinguisher at the time of the fire.

7. GENERAL INFORMATION.

a. Corrosion by Extinguishing Agents. Carbon dioxide is not corrosive and will have no damaging effect other than cold shock effect on ceramic electronic components. Water itself is not corrosive, but may be rendered corrosive by the addition of antifreeze solutions. Various dry chemical agents are corrosive to most sensitive electronic components and instruments.

b. Winterized Hand Fire Extinguishers. Hand fire extinguishers may be winterized down to a -65°F (-54°C). Extinguishers containing plain water only can be protected to temperatures as low as -40°F (-40°C) by the addition of an antifreeze stipulated on the extinguisher nameplate. Some extinguishers that use nitrogen as an expellant gas rather than carbon dioxide are approved or listed for temperatures as low as -65°F (-54°C).

c. Disadvantages of Dry Chemical Extinguishing Agents. When dry chemical fire extinguishers are discharged in crew compartments or confined areas, serious impairment to visibility will occur. Certain dry chemical agents also have a corrosive effect on electrical components.

d. Factory Sealed ("Disposable Type") Fire Extinguishers. Disposable type fire extinguishers should be maintained and inspected in accordance with the nameplate instructions.

(1) Nonrefillable disposable fire extinguishers have plastic discharge heads installed. Care should be exercised in the location of this type fire extinguisher to eliminate damage.

(2) Nonrefillable disposable fire extinguishers are exempt from the periodic hydrostatic test requirements.

(3) These type fire extinguishers are normally charged with a dry chemical extinguishing agent and have the same fogging effect and chemical reaction as standard dry chemical fire extinguishers.

e. Advantage of using Halogenated Agent Extinguishers.

(1) Halon 1211 is similar to CO_2 in that it is suitable for use in cold weather and leaves no residue.

(2) Halon 1211 is three times as effective as a CO_2 extinguisher having equal weight of agent.

(3) Halon 1211 is a liquefied gas which leaves the nozzle in a stream that is about 85 percent liquid and 15 percent gas. This gives the agent a range of 9 to 15 feet.

(4) Because it is a gas, at normal temperatures, Halon 1211 leaves no chemical residue behind to contaminate or corrode aircraft parts or surfaces.

(5) Other advantages of Halon 1211: lower cold shock characteristics on electronic equipment, no degradation of visual acuity, lower pressure, can be used for all classes of fires and has a 12-year hydrostatic test requirement.

f. Precautions.

(1) Tests indicate that human exposure to high levels of Halon vapors can result in dizziness, impaired coordination, and reduced mental sharpness. Exposure to the natural agent is generally of less concern than is exposure to the decomposition products. However, unnecessary exposure of personnel to either the natural agent or to the decomposition products should be avoided. Decomposition of all Halon vapors takes place on exposure to a flame, or to a hot surface at about 900°F (482°C). The decomposition products of Halon 1211 have a characteristic sharp, acrid odor, and an eye irritating effect, even in concentrations of only a few parts per million.

NOTE: Never discharge Halon 1211 on Class D (burning metal) fires.

(2) Inhalation of air containing a four to five percent concentration of Halon 1211 for one minute is the maximum that can be safely tolerated by human subjects. Underwriters Laboratories, Inc., recommends that the maximum concentration of Halon 1211 not exceed 2 percent at a temperature of 120°F (48.9°C). In order to determine the safe concentration of Halon 1211 in a given size compartment, the calculation for minimum compartment volume in cubic feet is determined by multiplying the charge weight of Halon 1211 in pounds by 124.7. The use of the nomographs in Figures 1, 2, and 3 will also aid in determining the air change time for a given compartment volume.

(3) As an example, the complete discharge of a 2.5 pound Halon 1211 extinguisher in a 120 cubic foot aircraft cabin (such as a Cessna 310) with no ventilation results in a concentration of 4.79 percent by volume. The discharge of two 2.5 pound Halon 1211 extinguishers in a McDonnell Douglas DC-9 (cockpit and cabin volume of 3,516 cubic feet) with no ventilation will result in a concentration of .32 percent by volume.

(4) Carbon dioxide fire extinguishers contain an extinguishing agent which will not support life when used in sufficient concentration to extinguish a fire. Prolonged occupancy of unventilated spaces can result in loss of consciousness due to oxygen deficiency.

g. Helpful Hints:

(1) Best results in fire fighting are generally obtained by attacking the base of the fire at the near edge of the fire and progressing toward the back of the fire by moving the nozzle rapidly with a side-to-side sweeping motion.

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(2) The effective discharge time of most hand held fire extinguishers ranges from 8 to 25 seconds depending on the capacity and type of the extinguisher. Due to this relatively short effective time span, the proper selection and use of the fire extinguisher must be made without delay.

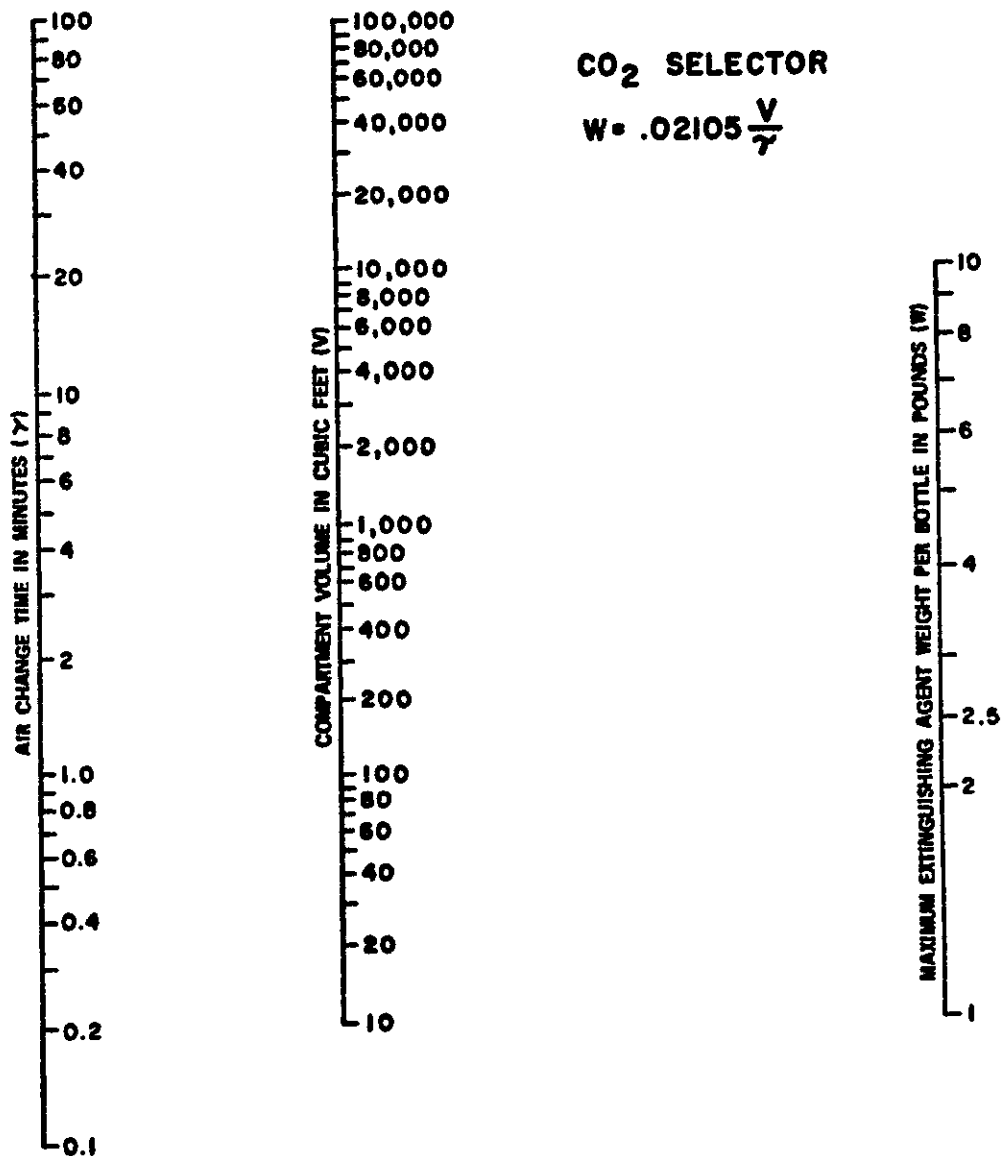
(3) Care must be taken not to direct the initial discharge directly at the burning surface at close range (less than 5 to 8 feet) because the high velocity stream may cause splashing and/or scattering of the burning material.

(4) When practical, extinguisher size selection should consider the volume and ventilation air change time of the compartment in which the extinguisher is to be used. The selector nomographs in Figures 1, 2, and 3 will match size to compartment volume and air change time such that extinguisher discharge will not produce an agent concentration greater than 4 percent-minute for Halon 1211, 10 for Halon 1301, or 25 for CO₂. These are the approximate maximum exposures considered advisable for aircraft occupants. If extinguishers larger than those indicated by the selector nomographs are installed, use of protective breathing equipment should be considered. These nomographs essentially are for pressurized aircraft for which air change rates are controllable and known. However, they also can serve to give perspective and background for extinguisher selection for small nonpressurized aircraft for which air change rates are not accurately known. To use a selector nomograph, extend a straight line across the three vertical scales, crossing the air change and compartment volume scales at the figures appropriate for the aircraft, and crossing the agent scale at weight appropriate for that air change time and volume.

(5) Ventilate the compartment promptly after successfully extinguishing the fire to reduce the gaseous combustion and gases produced by thermal decomposition.

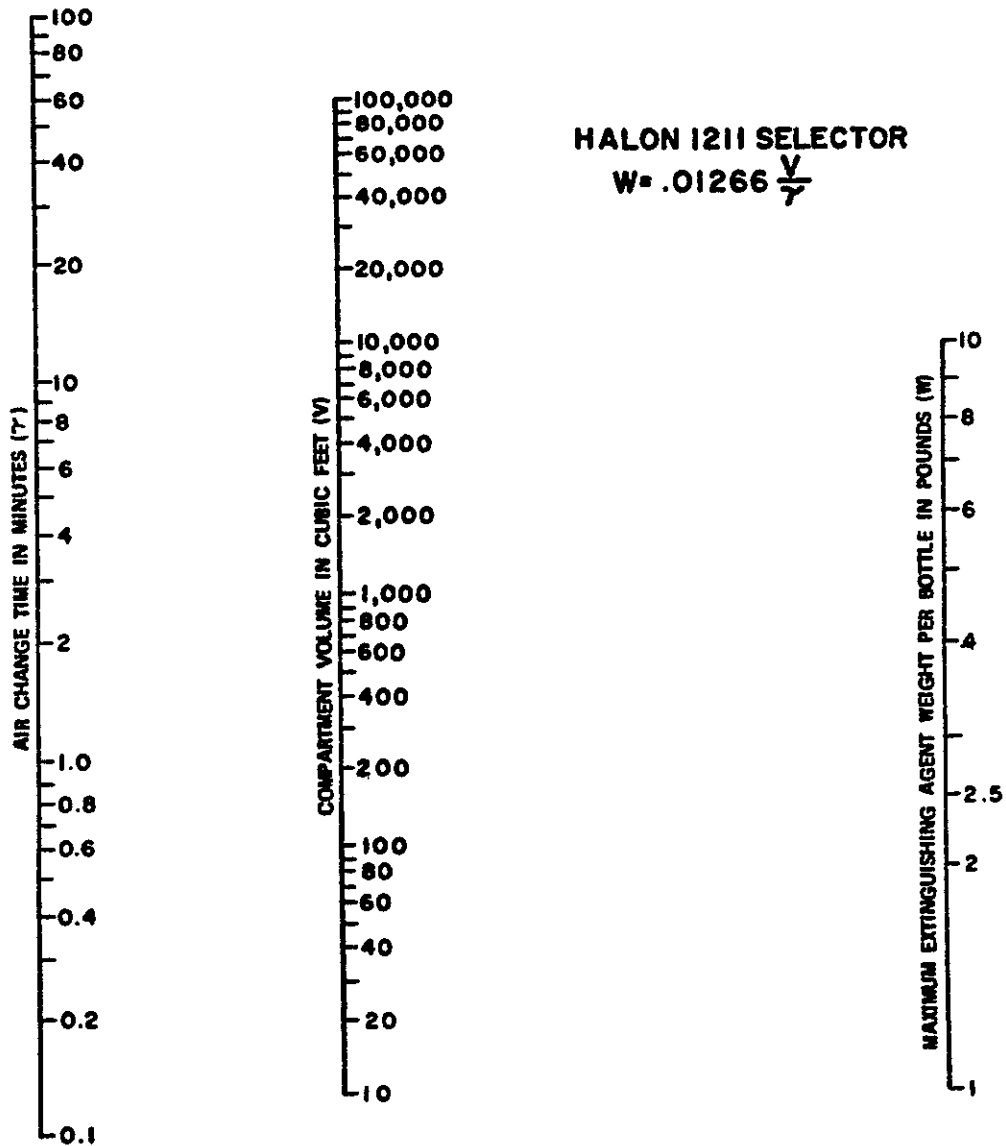


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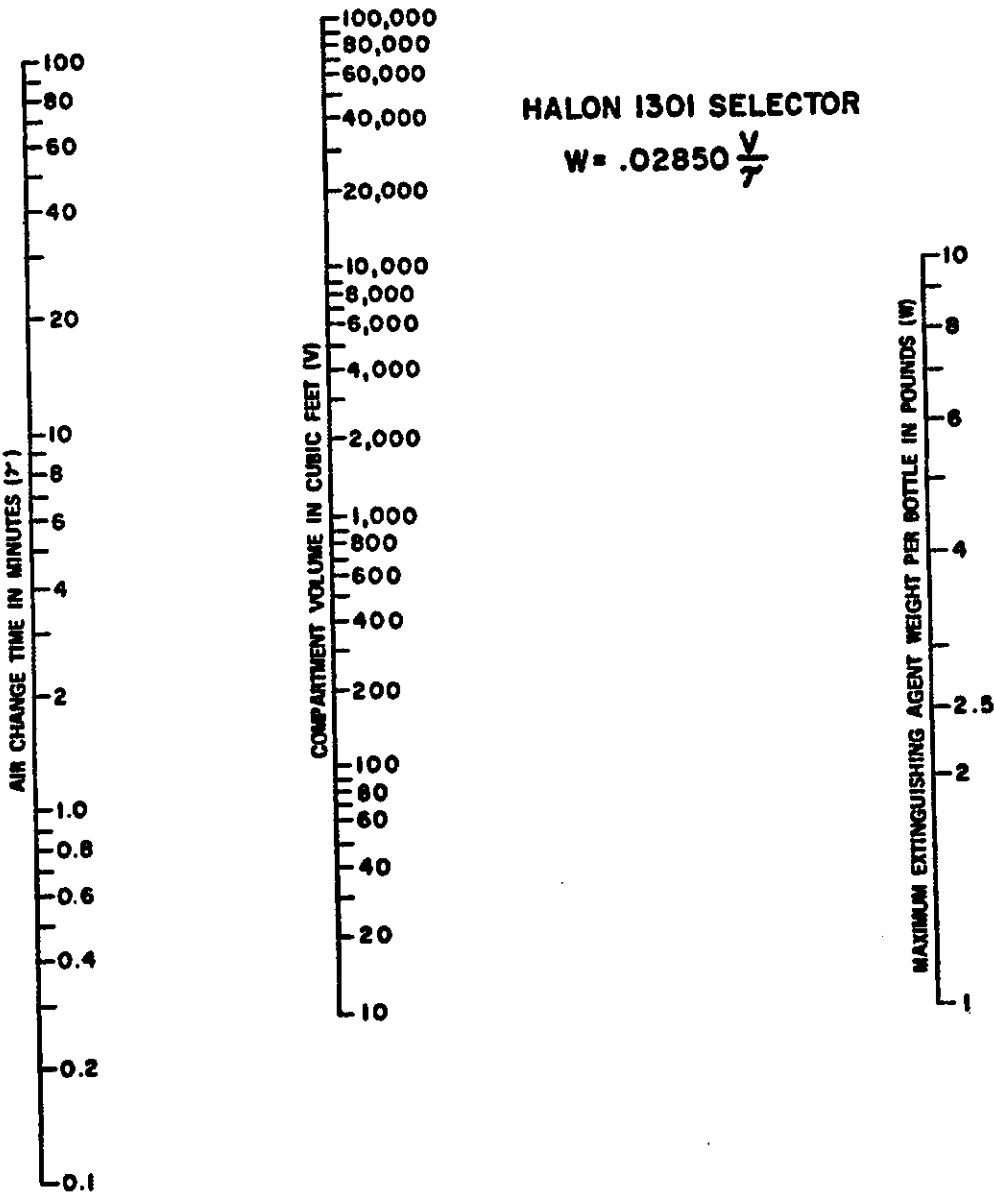
NOMOGRAPH, FIGURE 1

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NOMOGRAPH, FIGURE 2



NOMOGRAPH FIGURE 3





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M-794.4

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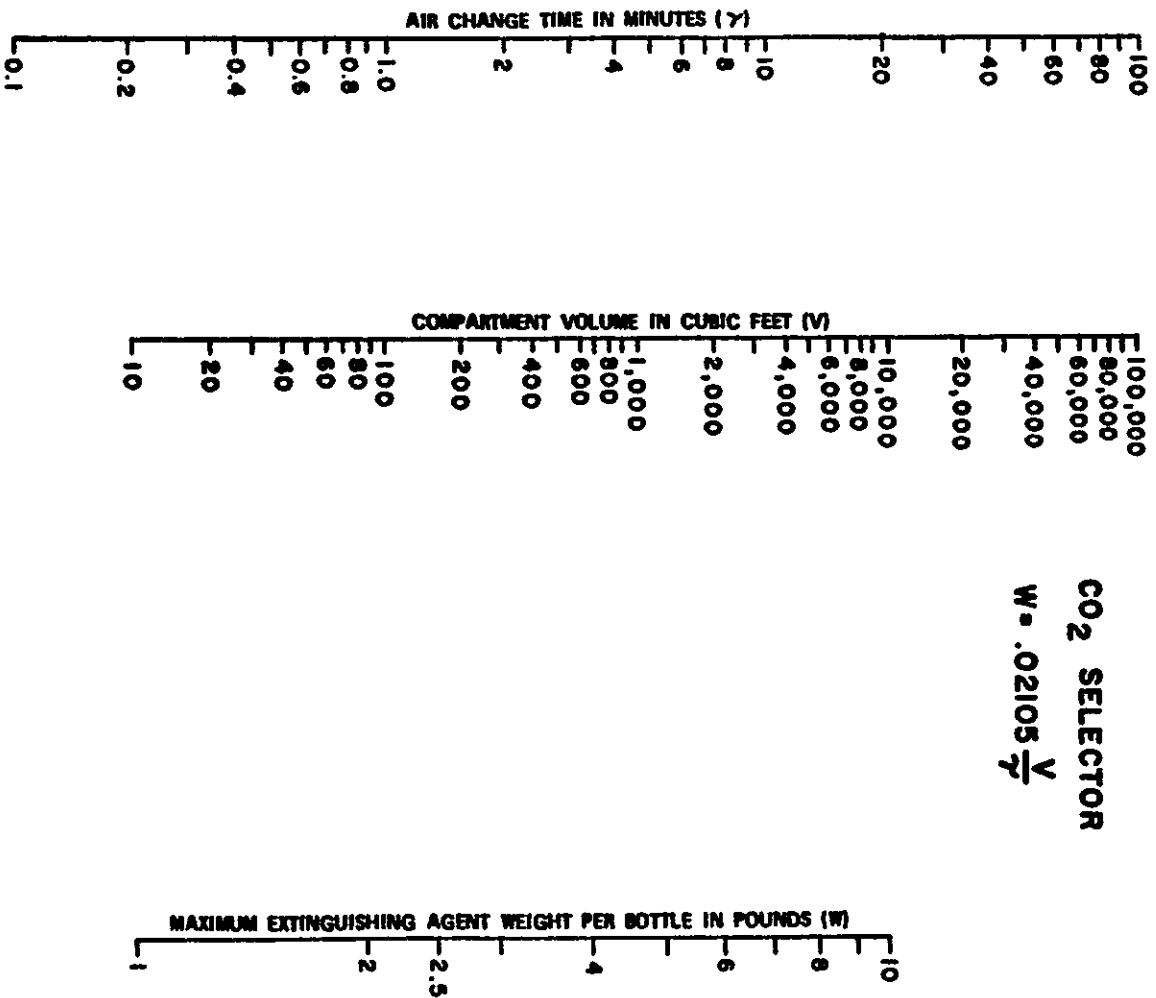
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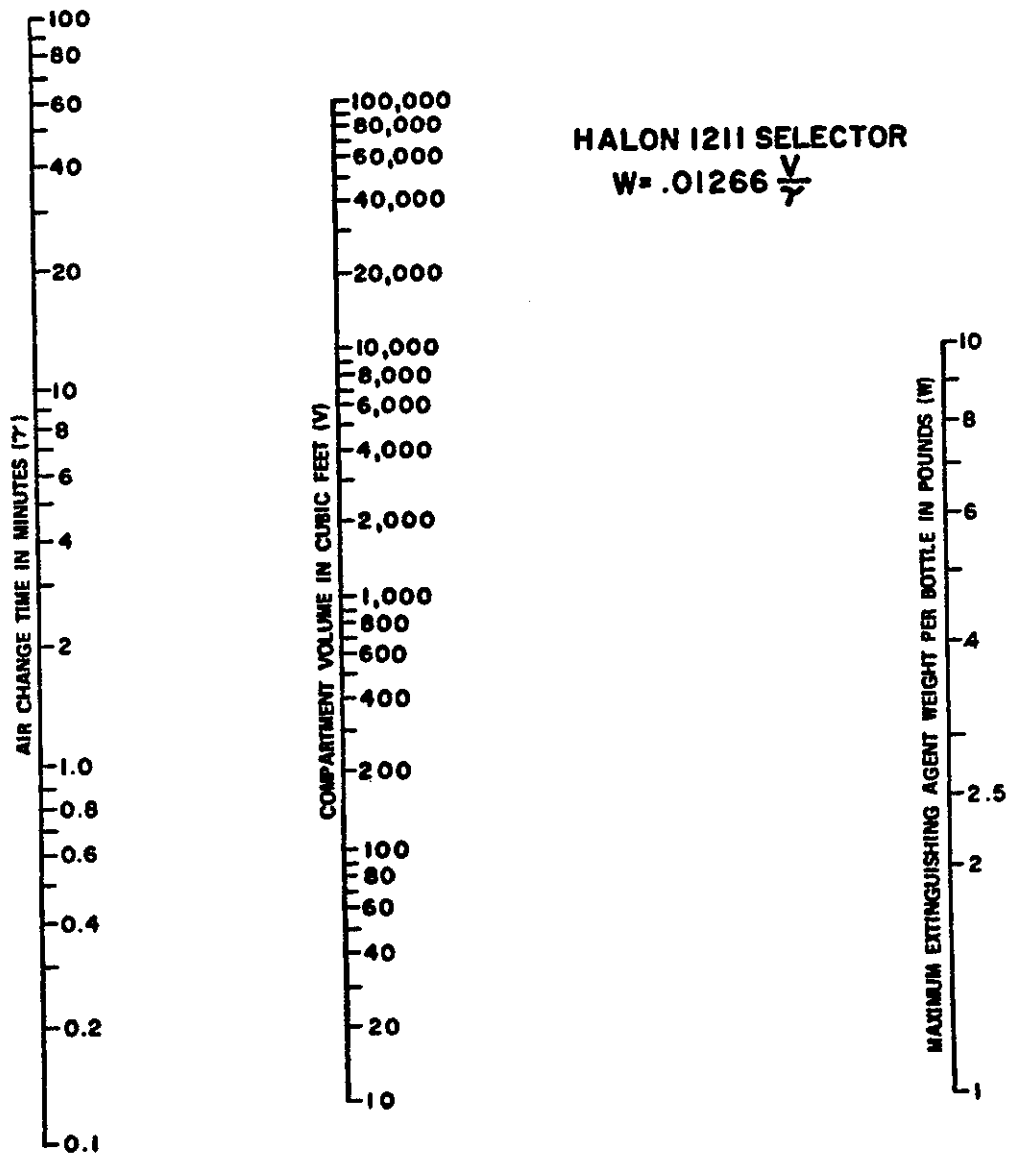


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NOMOGRAPH, FIGURE 1



NOMOGRAPH, FIGURE 2



NOMOGRAPH FIGURE 3