3701:1-46-45 **Prototype tests for luminous safety devices for use in aircraft.**

An applicant for a license pursuant to rule 3701:1-46-33 of the Administrative Code shall conduct prototype tests on each of five prototype luminous safety devices for use in aircraft as follows:

(A) Temperature-altitude test. The device shall be placed in a test chamber as it would be used in service. A temperature-altitude condition schedule shall be followed as outlined in table 1:

Table 1 - Temperature-altitude test

Step 1	The internal temperature of the test chamber shall be reduced to - 62º C (- 80º F) and the device shall be maintained for at least one hour at this temperature at atmospheric pressure.
Step 2	The internal temperature of the test chamber shall be raised to - 54º C (- 65º F) and maintained until the temperature of the device has stabilized at - 54º C (- 65º F) at atmospheric pressure.
Step 3	The atmospheric pressure of the chamber shall be reduced to eighty-three millimeters of mercury absolute pressure while the chamber temperature is maintained at - 54º C (- 65º F).
Step 4	The internal temperature of the chamber shall be raised to - 10º C (14º F) and maintained until the temperature of the device has stabilized at - 10º C (14º F), and the internal pressure of the chamber shall then be adjusted to atmospheric pressure. The test chamber door shall then be opened in order that frost will form on the device, and shall remain open until the frost has melted but not long enough to allow the moisture to evaporate. The door shall then be closed.
Step 5	The internal temperature of the chamber shall be raised to 85º C (185º F) at atmospheric pressure. The temperature of the device shall be stabilized at 85º C (185º F) and maintained for two hours. The device shall then be visually inspected to determine the extent of any deterioration.
Step 6	The chamber temperature shall be reduced to 71º C (160º F) at atmospheric pressure. The temperature of the device shall be stabilized at 71º C (160º F) for a period of thirty minutes.
Step 7	The chamber temperature shall be reduced to 55º C (130º F) at atmospheric pressure. The temperature of the device shall be stabilized at this temperature for a period of four hours.
Step 8	The internal temperature of the chamber shall be reduced to 30º C (86º F) and the pressure to one hundred thirty-eight millimeters of mercury absolute pressure and stabilized. The device shall be maintained under these

	conditions for a period of four hours.
Step 9	The temperature of the test chamber shall be raised to 35º C (95º F) and the pressure reduced to eighty-three millimeters of mercury absolute pressure and stabilized. The device shall be maintained under these conditions for a period of thirty minutes.
Step 10	The internal pressure of the chamber shall be maintained at eighty-three millimeters of mercury absolute pressure and the temperature reduced to 20º C (68º F) and stabilized. The device shall be maintained under these conditions for a period of four hours.

(B) Vibration tests. This procedure applies to items of equipment (including vibration isolating assemblies) intended to be mounted directly on the structure of aircraft powered by reciprocating, turbojet, or turbo-propeller engines or to be mounted directly on gas-turbine engines. The device shall be mounted on an apparatus dynamically similar to the most severe conditions likely to be encountered in normal use. At the end of the test period, the device shall be inspected thoroughly for possible damage. Vibration tests shall be conducted under both resonant and cycling conditions according to the following vibration test schedule (table 2)

Table 2 - Vibration test schedule (times shown refer to one axis of vibration)

Type	Vibration at room temperature (minutes)	Vibration at ~~160º F (71º C.)~~71º C (160º F) (minutes)	Vibration at ~~-65º F (-54º C.)~~- 54º C (-65º F) (minutes)
Resonance	60	15	15
Cycling	60	15	15

(1) Determination of resonance frequency. Individual resonance frequency surveys shall be conducted by applying vibration to each device along each of any set of three mutually perpendicular axes and varying the frequency of applied vibration slowly through a range of frequencies from five cycles per second to five hundred cycles per second with the double amplitude of the vibration not exceeding that shown in figure 1 for the related frequency.

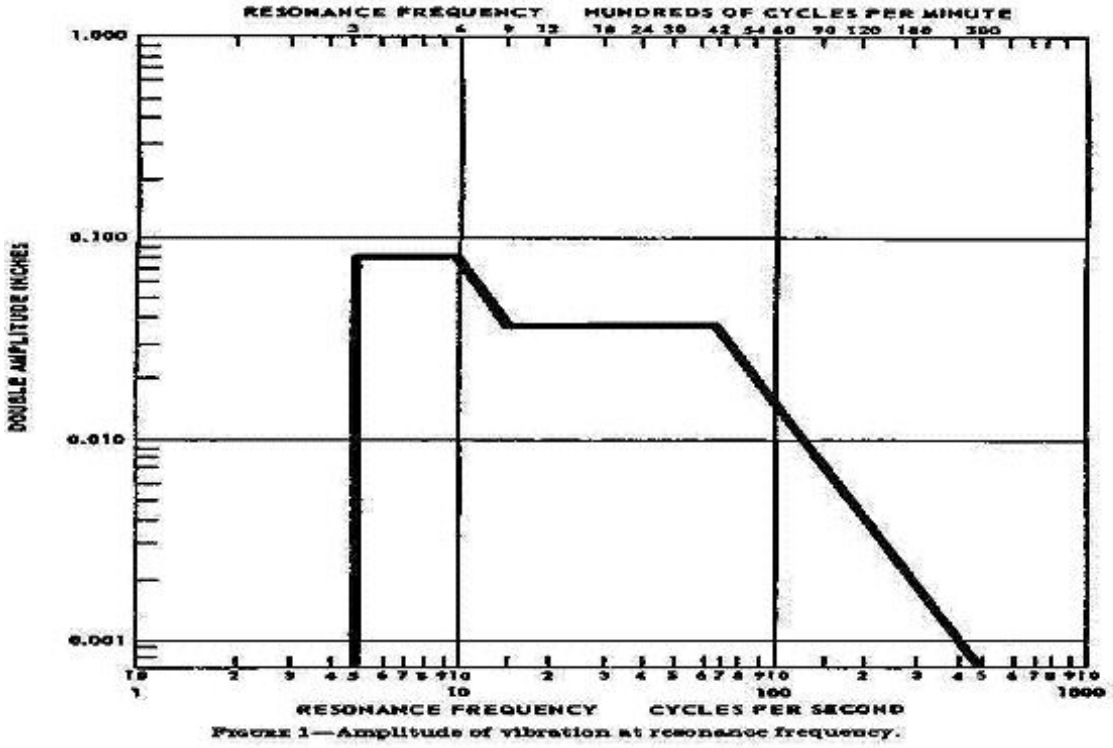

Figure 1—Amplitude of vibration at resonance frequency.

(2) Resonance tests. The device shall be vibrated at the determined resonance frequency for each axis of vibration for the periods and temperature conditions shown in table 1 and with the applied double amplitude specified in figure 1 for that resonance frequency. When more than one resonant frequency is encountered with vibration applied along any one axis, the test period may be accomplished at the most severe resonance or the period may be divided among the resonant frequencies, whichever is considered most likely to produce failure. When resonant frequencies are not apparent within the specified frequency range, the specimen shall be vibrated for periods twice as long as those shown for resonance in table 2 at a frequency of fifty-five cycles per second and an applied double amplitude of 0.060 inch.

(3) Cycling. Devices to be mounted only on vibration isolators shall be tested by applying vibration along each of three mutually perpendicular axes of the device with an applied double amplitude of 0.060 inch and the frequency cycling between ten and fifty-five cycles per second in one minute cycles for the periods and temperature conditions shown in table 2. Devices to be installed in aircraft without vibration isolators shall be tested by applying vibration along each of three mutually perpendicular axes of the device with an applied double amplitude of 0.036 inch or an applied acceleration of ten G, whichever is the limiting value, and the frequency cycling between ten and

five hundred cycles per second in fifteen minute cycles for the periods and temperature conditions shown in table 2.

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(C) Accelerated weathering tests. The device shall be subjected to one hundred hours of accelerated weathering in a suitable weathering machine. Panels of Corex D glass shall surround the arc to cut off the ultraviolet radiation below a wave length of two thousand seven hundred angstroms. The light of the carbon arcs shall fall directly on the face of the device. The temperature at the sample shall be maintained at fifty degrees celsius plus or minus three degrees celsius. Temperature measurements shall be made with a black panel thermometer.

(D) Shock test. The device shall be dropped upon a concrete or iron surface in a three foot free gravitational fall, or shall be subjected to equivalent treatment in a test device simulating such a free fall. The drop test shall be repeated one hundred times from random orientations.

(E) Hermetic seal and waterproof test. On completion of all other tests prescribed by this section, the device shall be immersed in thirty inches of water for twenty-four hours and shall show no visible evidence of water entry. Absolute pressure of the air above the water shall then be reduced to one inch of mercury. Lowered pressure shall be maintained for one minute or until air bubbles cease to be given off by the water, whichever is the longer. Pressure shall then be increased to normal atmospheric pressure. Any evidence of bubbles emanating from within the device, or water entering the device, shall be considered leakage.

(F) Observations. After each of the tests prescribed by this rule, each device shall be examined for evidence of physical damage and for loss of tritium or promethium-147. Any evidence of damage to or failure of any device which could affect containment of the tritium or promethium-147 shall be cause for rejection of the design if the damage or failure is attributable to a design defect. Loss of tritium or promethium-147 from each tested device shall be measured by wiping with filter paper an area of at least one hundred square centimeters on the outside surface of the device, or by wiping the entire surface area if it is less than one hundred square centimeters. The amount of tritium or promethium-147 in the water used in the hermetic seal and waterproof test prescribed by paragraph (E) of this rule shall also be measured. Measurements shall be made in an apparatus calibrated to measure tritium or promethium-147, as appropriate. The detection on the filter paper of more than two thousand two hundred disintegrations per minute of tritium or promethium-147 per one hundred square centimeters of surface wiped or in the water of more than 0.1 ~~percent~~per cent of the original amount of tritium or promethium-147 in any device shall be cause for rejection of the tested device.

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Certification

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Date

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