4731.3405 PROTOTYPE TESTS; LUMINOUS SAFETY DEVICES FOR AIRCRAFT.

Subpart 1. **Applicability.** An applicant for a license under part 4731.3345 must conduct prototype tests on each of five prototype luminous safety devices for use in aircraft according to this part.

Subp. 2. **Temperature-altitude test.** The device must be placed in a test chamber as it would be used in service. A temperature-altitude condition schedule must be followed as outlined in the following steps in items A to J.

A. Step 1. The internal temperature of the test chamber must be reduced to -62° Celsius (-80° Fahrenheit) and the device must be maintained for at least one hour at this temperature at atmospheric pressure.

B. Step 2. The internal temperature of the test chamber must be raised to -54° Celsius (-65° Fahrenheit) and maintained until the temperature of the device has stabilized at -54° Celsius at atmospheric temperature.

C. Step 3. The atmospheric pressure of the chamber must be reduced to 83 millimeters of mercury absolute pressure while the chamber temperature is maintained at -54° Celsius.

D. Step 4. The internal temperature of the chamber must be raised to -10° Celsius (+14° Fahrenheit) and maintained until the temperature of the device has stabilized at -10° Celsius and the internal pressure of the chamber must then be adjusted to atmospheric pressure. The test chamber door must then be opened to allow frost to form on the device, and must remain open until the frost has melted but not long enough to allow the moisture to evaporate. The door must then be closed.

E. Step 5. The internal temperature of the chamber must be raised to +85° Celsius (+185° Fahrenheit) at atmospheric pressure. The temperature of the device must be stabilized at +85° Celsius and maintained for two hours. The device must then be visually inspected to determine the extent of any deterioration.

F. Step 6. The chamber temperature must be reduced to +71° Celsius (+160° Fahrenheit) at atmospheric pressure. The temperature of the device must be stabilized at +71° Celsius for 30 minutes.

G. Step 7. The chamber temperature must be reduced to +55° Celsius (+130° Fahrenheit) at atmospheric pressure. The temperature of the device must be stabilized at this temperature for four hours.

H. Step 8. The internal temperature of the chamber must be reduced to +30° Celsius (+86° Fahrenheit) and the pressure to 138 millimeters of mercury absolute pressure and stabilized. The device must be maintained under these conditions for four hours.

I. Step 9. The temperature of the test chamber must be raised to +35° Celsius (+95° Fahrenheit) and the pressure reduced to 83 millimeters of mercury absolute pressure and stabilized. The device must be maintained under these conditions for 30 minutes.

J. Step 10. The internal pressure of the chamber must be maintained at 83 millimeters of mercury absolute pressure and the temperature reduced to +20° Celsius (+68° Fahrenheit) and stabilized. The device must be maintained under these conditions for four hours.

Subp. 3. **Vibration tests.**

A. 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 must 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 must be inspected thoroughly for possible damage. Vibration tests must be conducted under both resonant and cycling conditions.

B. Vibration test schedule.

Times shown refer to one axis of vibration:

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

C. Individual resonance frequency surveys must 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 though a range of frequencies from five cycles per second to 500 cycles per second with the double amplitude of the vibration not exceeding that shown in Figure 1 for the related frequency.

D. The device must be vibrated at the determined resonance frequency for each axis of vibration for the periods and temperature conditions shown in item B 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 must be vibrated for periods twice as long as those shown for resonance in

item B at a frequency of 55 cycles per second and an applied double amplitude of 0.060 inch.

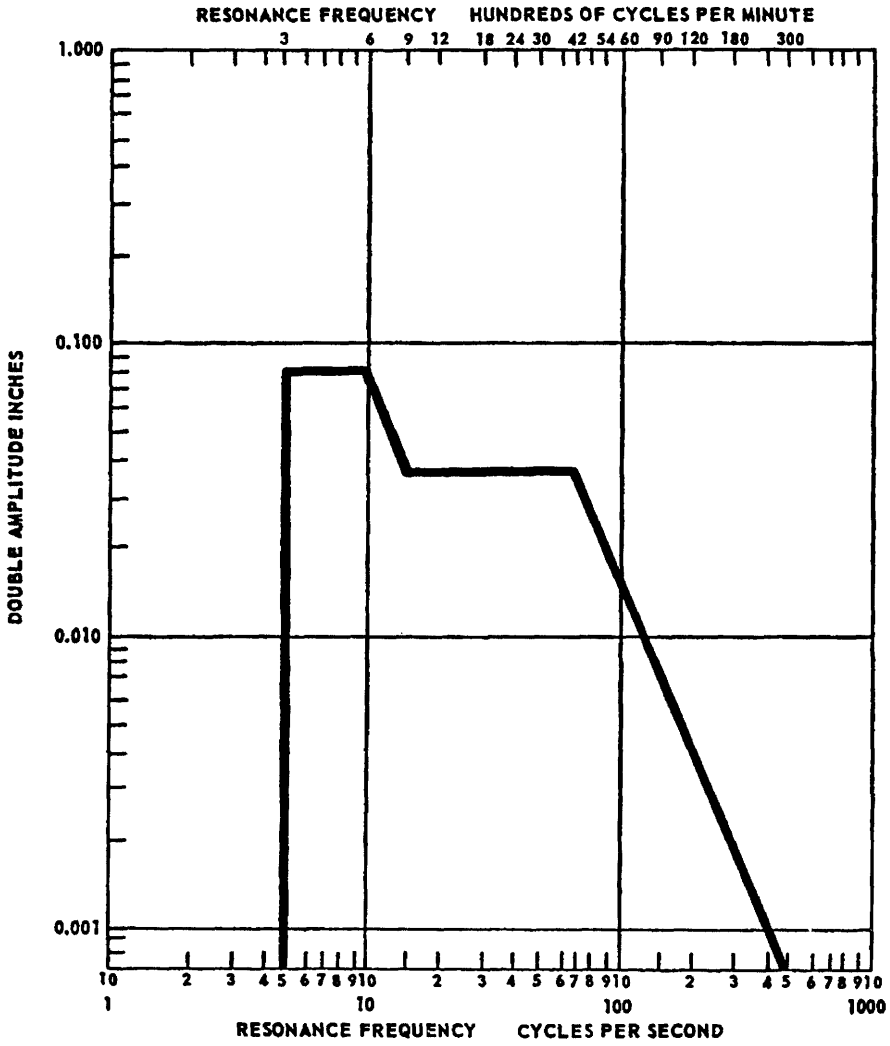

FIGURE 1: AMPLITUDE OF VIBRATION AT RESONANCE FREQUENCY

E. Devices to be mounted only on vibration isolators must 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 55 cycles per second in one-minute cycles for the periods and temperature conditions shown in item B. Devices to be installed in aircraft without vibration isolators must 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 10G, whichever is the limiting value, and the frequency cycling between ten and 500 cycles per second on 15-minute cycles for the periods and temperature conditions shown in item B.

Subp. 4. **Accelerated weathering tests.** The device must be subject to 100 hours of accelerated weathering in a suitable weathering machine. Panels of Corex D glass must

surround the arc to cut off the ultraviolet radiation below a wavelength of 2,700 angstroms. The light of the carbon arcs must fall directly on the face of the device. The temperature at the sample must be maintained at 50° Celsius, plus or minus 3° Celsius. Temperature measurements must be made with a black panel thermometer.

Subp. 5. **Shock test.** The device must be dropped upon a concrete or iron surface in a three-foot free gravitational fall, or must be subjected to equivalent treatment in a test device simulating such a free fall. The drop test must be repeated 100 times from random orientations.

Subp. 6. **Hermetic seal and waterproof test.** On completion of all other tests required by this part, the device must be immersed in 30 inches of water for 24 hours and must show no visible evidence of water entry. Absolute pressure of the air above the water must then be reduced to one inch of mercury. Lowered pressure must be maintained for one minute or until air bubbles cease to be given off by the water, whichever is the longer. Pressure must then be increased to normal atmospheric pressure. Any evidence of bubbles emanating from within the device, or water entering the device, must be considered leakage.

Subp. 7. **Observations.** After each of the tests required by this part, each device must 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 that could affect containment of the tritium or promethium-147 must 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 must be measured by wiping with filter paper an area of at least 100 square centimeters on the outside surface of the device, or by wiping the entire surface area if it is less than 100 square centimeters. The amount of tritium or promethium-147 in the water used in the hermetic seal and waterproof test under subpart 6 must also be measured. Measurements must be made in an apparatus calibrated to measure tritium or promethium-147, as appropriate. The detection on the filter paper of more than 2,200 disintegrations per minute of tritium or promethium-147 per 100 square centimeters of surface wiped or in the water of more than 0.1 percent of the original amount of tritium or promethium-147 in any device must be cause for rejection of the tested device.

Statutory Authority: *MS s 144.1202; 144.1203*

History: *29 SR 755*

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