

NOTE: This amendment
contains TSO-C72a

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Title 14—AERONAUTICS AND SPACE

Chapter I—Federal Aviation Agency

SUBCHAPTER C—AIRCRAFT

[Docket No. 7101; Amdt. 37-8]

PART 37—TECHNICAL STANDARD ORDER AUTHORIZATIONS

Individual Flotation Devices— TSO-C72a

The purpose of this amendment is to revise the Technical Standard Order (TSO-C72) for individual flotation devices contained in § 37.178 of the Federal Aviation Regulations. This action was published as a notice of proposed rule making (31 F.R. 296, Jan. 11, 1966) and circulated as Notice No. 66-1 dated January 5, 1966.

Notice 66-1 proposed an amendment to clarify the buoyancy testing requirements that were stated in TSO-C72 in broad objective terms. The proposal incorporated and described two alternative test procedures applicable to inflatable and noninflatable devices—a survivor (human) test and a machine test. In addition, the notice proposed to amend the buoyancy test requirements to make it clear that the tests may be conducted under other than standard water conditions provided the results can be converted to standard conditions.

In response to the notice of proposed rule making a number of comments pointed out that although the TSO requires allowance for the effects of extended service use, the proposed buoyancy test procedures are not realistic in several respects and do not account for loss of buoyancy caused by aging of materials or by permanent compression from in-service (cabin) usage. The Agency considers that these comments have merit and paragraph 7.0.1 is revised to include objective test procedures to account for aging through either preconditioning the test specimens or demonstrating excess buoyancy to offset the aging loss.

Recommending clarification or change to those portions of the TSO not covered by the proposal and which state that dress covers enveloping flotation devices

are not considered to be part of the device, one commentator advised that actual practice is to the contrary inasmuch as dress covers are a part of seat cushions. The provision excluding covers was incorporated into the original TSO because it was considered conservative to exclude the effects of incidentally entrapped air in the covers, particularly during simple short-period static immersion tests. While it would be unrealistic to rely on covers generally to provide a dependable increment of total buoyancy, nevertheless it appears possible to develop dress coverings that have adequate air retention characteristics. Furthermore, the dynamic test conditions being introduced by this amendment will prove the effectiveness and durability of covers in augmenting buoyancy. Therefore, since the reasons for excluding covers no longer appear valid, the Agency considers it appropriate to further amend the TSO by deleting those sentences that exclude dress covers as parts of flotation devices, and at the same time, to require that buoyancy tests be conducted on complete devices configured as they would normally be for emergency use.

Most of the comments took issue with one or more features of the proposed machine test and two commentators objected to that test in its entirety. The essential thrust of the objections was that the test does not duplicate the actual conditions of use and would be unreasonably difficult and costly to perform. It was pointed out that the 10-foot depth would never be reached by a person holding on to the device and, in any event, hydrostatic pressure at that depth, rather than simulating the effect of squeezing, would tend to seal the device and stop leaks. The comments significantly emphasized that static immersion tests for a predetermined time at a nominal depth of 2 feet are adequate to determine buoyancy for closed cell materials, whereas, for open cell material, immersion at or just below the water surface coupled with the cyclic squeezing action characteristic of a human would be required.

The Agency appreciates the distinction between open cell and closed cell materials and the importance of tests that are representative of the conditions under which such devices will be used. Accordingly, the proposed paragraph 7.0.1 has been recast to require tests appropriate

(As published in the Federal Register /31 F.R. 12941/ on October 5, 1966)

1750 [/ 37]

to the material involved and to permit the use of a mechanical apparatus in the tests provided it simulates the squeezing motions characteristic of humans.

One suggestion would have required buoyancy measurements to be made in accordance with U.S. Coast Guard Specification Subpart No. 16.049, Second Amendment. However, that specification does not require preconditioning to simulate the effects of aging nor does it require squeezing to account for repetitive cycling during emergency use. For these reasons, the TSO has not been changed as suggested.

A recommendation that testing be conducted in a swimming pool or similar test area has been adopted and further expanded to make it clear that testing may be conducted in either open or restricted water areas.

A number of comments were directed to the proposed duration of the tests. Two commentators expressed agreement with 8 hours insofar as static immersion tests for closed cell materials are concerned or where a dummy or equivalent is used in place of a human subject. To the contrary, one commentator stated that the proposed 8-hour demonstration in 2-foot waves is unwarranted in view of the Agency's previously established position that individual flotation devices are not intended to be the equivalent of life preservers but only to provide the minimum of buoyancy when rescue is close at hand. Another commentator alleged that the proposed test duration of 8 hours was unrealistic for domestic routes and recommended 4 hours since that would be the maximum time before rescue would take place.

Of the comments opposing the proposed 8-hour test, the most analytical pointed out that testing in 2-foot waves for 8 hours was unnecessarily severe and presented a hardship in proving compliance. This commentator cited industry tests tending to prove that when devices lose buoyancy they do so rapidly, usually in the first 30 minutes, and if buoyancy stabilizes to a constant value for a period of 2 hours, the buoyancy at the end of 8 hours can be predicted. The commentator therefore recommended TSO buoyancy testing durations and conditions in keeping with its findings. The Agency agrees in principle with the analysis and recommendations expressed by this commentator and has revised the proposal to allow the tests to be stopped when buoyancy has stabilized over 4 successive 30-minute measurement intervals.

One commentator contended that present cushion material (polyurethane foam) will not meet the proposed buoyancy testing requirements, and, if other materials are used to attain the necessary buoyancy, the cushions will be more flammable. However, the commentator makes no claim that, nor is the Agency aware of any reason why, polyurethane foam cushions may not be designed to meet the buoyancy test. In fact, tests conducted by the Agency have indicated

that polyurethane foam cushions encased in a waterproof covering do meet the buoyancy test.

Noting that the flame-resistance test procedure of TSO-C72 is applicable only to fabric-type materials, one comment recommended that such procedures should be extended to cover foam. While this comment may have merit, it goes beyond the scope of Notice 66-1. However, the Agency has published Notice No. 66-26 (31 F.R. 10275, July 29, 1966) concerning Crashworthiness and Passenger Evacuation, in which changes to the flame-resistant requirements of TSO-C72 have been proposed. Recommendations relating to flame-resistance testing of individual flotation devices would properly be responsive to Notice 62-26.

In response to comments, the TSO has been further amended to make it clear that flotation device models approved prior to the effective date of this amendment may continue to be manufactured under the provisions of their original approval.

The phrase "for use on civil aircraft of the United States" has been deleted from the applicability provision of the revised TSO. As indicated in the preambles to TSO-C50b (31 F.R. 9977, July 22, 1966) and TSO-C87 (30 F.R. 15547, Dec. 17, 1965), such phrases have created some confusion and serve no useful purpose insofar as the TSO is concerned. A TSO contains those standards that a manufacturer must meet in order to identify his equipment with the applicable TSO marking. A manufacturer desiring to use the applicable TSO marking must meet the prescribed standard regardless of the type of operation or the type of aircraft in which the equipment might be used.

In view of the fact that clarifying amendments are being made to the requirements of § 37.178 in addition to the substantive changes to the Federal Aviation Agency Standard as proposed, the Agency considers it appropriate in the interest of clarity to set forth the TSO in its entirety. In this connection, minor changes of an editorial nature have been made in the text of the standard.

Interested persons have been afforded the opportunity to participate in the making of this amendment. All relevant material submitted has been fully considered.

(Secs. 313(a), 601, Federal Aviation Act of 1958; 49 U.S.C. 1354, 1421)

In consideration of the foregoing and pursuant to the authority delegated to me by the Administrator (25 F.R. 6489), § 37.178 of Part 37 of the Federal Aviation Regulations is amended as herein-after set forth below, effective November 4, 1966.

Issued in Washington, D.C., on September 28, 1966.

C. W. WALKER,
Director, Flight Standards Service.

§ 37.178 Individual flotation devices— TSO-C72a.

(a) *Applicability.* This Technical Standard Order (TSO) prescribes the minimum performance standards that individual flotation devices must meet in order to be identified with the applicable TSO marking. New models of the equipment that are to be so identified, and that are manufactured on or after November 4, 1966, must meet the requirements of the "Federal Aviation Agency Standard, Individual Flotation Devices" set forth at the end of this section.

(b) *Marking.* The marking specified in § 37.7(d) must be shown except that the weight need not be included.

(c) *Data requirements.* In addition to the data specified in § 37.5, the manufacturer must furnish to the Chief, Engineering and Manufacturing Branch, Flight Standards Division, Federal Aviation Agency, in the region in which the manufacturer is located, the following technical data:

(1) Six copies of the descriptive information on the device.

(2) Six copies of the manufacturers' equipment operating instructions and limitations.

(3) Six copies of the applicable installation instructions indicating any restrictions or other conditions pertinent to installation.

(4) One copy of the manufacturers' test report.

(5) One copy of the manufacturers' special cleaning and maintenance instructions.

(d) *Previously approved equipment.* Flotation device models approved prior to November 4, 1966, may continue to be manufactured under the provisions of their original approval.

FEDERAL AVIATION AGENCY STANDARD INDIVIDUAL FLOTATION DEVICES

1.0 *Purpose.* To specify minimum performance standards for individual flotation devices other than life preservers defined in the TSO-C13 Series.

2.0 *Types and description of devices.* This standard provides for the following two categories of individual flotation devices:

a. Inflatable types (compressed gas inflation).

b. Noninflatable types.
2.0.1 *Description of inflatable types.* Inflation must be accomplished by release of a compressed gas contained in a cartridge into the inflation chamber. The cartridge must be activated by a means readily accessible and clearly marked for its intended purpose. The flotation chamber must also be capable of oral inflation in the event of failure of the gas cartridge.

2.0.2 *Description of noninflatable types.* Seat cushions, head rests, arm rests, pillows or similar aircraft equipment are eligible as flotation devices under this standard provided they fulfill minimum requirements for safety and performance. Compression through extended service use, perspiration and periodic cleaning must not reduce the buoyancy characteristics of these devices below the minimum level prescribed in this standard.

2.1 *Instructions for use.* Where the design features of the device relative to its

purpose and proper use are not obvious to the user, clearly worded instructions must be provided. These instructions must be visible under conditions of emergency lighting.

3.0 *Definitions.* The following are definitions of terms used throughout the standard:

a. *Buoyancy.* The amount of weight a device can support in fresh water at 85° F.

b. *Flame resistant.* Not susceptible to combustion to the point of propagating a flame beyond safe limits after the ignition source is removed.

c. *Corrosion resistant.* Not subject to deterioration or loss of strength as a result of prolonged exposure to a humid atmosphere.

4.0 *General requirements—4.0.1 Materials and processes.* Materials used in the finished product must be of the quality which experience and tests have demonstrated to be suitable for the use intended throughout the service life of the device. The materials and processes must conform to specifications selected or prepared by the manufacturer which will insure that the performance, strength and durability incorporated in the prototype are continued or exceeded in subsequently produced articles.

4.0.2 *Fungus protection.* Materials used in the finished product must contain no nutrient which will support fungus growth unless such materials are suitably treated to prevent such growth.

4.0.3 *Corrosion protection.* Metallic parts exposed to the atmosphere must be corrosion resistant or protected against corrosion.

4.0.4 *Flame resistance.* All materials used in the device, including any covering, must be flame resistant.

4.0.5 *Temperature range.* Materials used in the construction of the device must be suitable for the intended purpose following extended exposures through a range of operating temperatures from -40° F. to +140° F.

4.1 *Design and construction—4.1.1 General.* The design of the device, the inflation means if provided, and straps or other accessories provided for the purpose of donning by the user must be simple and obvious thereby making its purpose and actual use immediately evident to the user.

4.1.2 *Miscellaneous design features.* The devices must be adaptable for children as well as adults. They must have features which enable the users to retain them when jumping into the water from a height of at least 5 feet. Attachment straps must not pass between the user's legs for retention or restrict breathing or blood circulation.

5.0 *Performance characteristics—5.0.1 Buoyancy standard.* The device must be shown by the tests specified in paragraph 7.0.1 to be capable of providing not less than 14 pounds of buoyancy in fresh water at 85° F. for a period of 8 hours.

5.0.2 *Utilization.* The devices must be capable of being utilized by the intended user with ease.

5.0.3 *Function under temperature limits.* The device must be functional within the

temperature limitations of -40° F. to +140° F.

6.0 *Standard test procedures—6.0.1 Salt spray test solution.* The salt used must be sodium chloride or equivalent containing on the dry basis not more than 0.1 percent of sodium iodide and not more than 0.2 percent of impurities. The solution must be prepared by dissolving 20 ± 2 parts by weight of salt in 80 parts by weight of distilled or other water containing not more than 200 parts per million of total solids. The solution must be kept free from solids by filtration, decantation, or any other suitable means. The solution must be adjusted to be maintained at a specific gravity of from 1.126 to 1.157 and a PH of between 6.5 and 7.2 when measured at a temperature in the exposure zone maintained at 95° F.

6.0.2 *Flame resistance.* Three specimens approximately 4 inches wide and 14 inches long must be tested. Each specimen must be clamped in a metal frame so that the two long edges and one end are held securely. The frame must be such that the exposed area of the specimen is at least 2 inches wide and 13 inches long with the free end at least one-half inch from the end of the frame for ignition purposes. In the case of fabrics, the direction of the weave corresponding to the most critical burn rate must be parallel to the 14-inch dimension. A minimum of 10 inches of the specimen must be used for timing purposes, and approximately $1\frac{1}{2}$ inches must burn before the burning front reaches the timing zone. The specimen must be long enough so that the timing is stopped at least 1 inch before the burning front reaches the end of the exposed area.

The specimens must be supported horizontally and tested in draft free conditions. The surface that will be exposed when installed in the aircraft must face down for the test. The specimens must be ignited by a Bunsen or Tirrell burner. To be acceptable, the average burn rate of the three specimens must not exceed 4 inches per minute. Alternatively, if the specimens must not support combustion after the ignition flame is applied for 15 seconds or if the flame extinguishes itself and subsequent burning without a flame does not extend into the undamaged areas, the material is also acceptable.

7.0 *Test requirements—7.0.1 Buoyancy testing.* The flotation device, including all dress covers, and straps that would normally be used by a survivor in an emergency, must be tested in accordance with either subparagraph (a) or (b) of this paragraph, as applicable, or an equivalent test procedure. The test may be conducted using non-fresh water, or at a temperature other than 85° F., or both, provided the result can be converted to the standard water condition specified in paragraph 5.0.1. The test may be conducted in open (ocean or lake) or restricted (swimming pool) water. The test specimen of non-inflatable devices, such as pillows or seat

cushions, must either be preconditioned to simulate any detrimental effects on buoyancy resulting from extended service use or an increment must be added to the buoyancy standard in paragraph 5.0.1 sufficient to offset any reduction in buoyancy which would result from extended service use.

a. *Test procedures applicable to inflatable devices and to noninflatable devices made from closed cell material.* The device must be tested by submerging it in water so that no part of it is less than 24 inches below the surface. It must be shown that the buoyancy of the device is at least equal to the value specified in paragraph 5.0.1 after submersion for at least 8 hours, except that the test may be discontinued in less than 8 hours if buoyancy measurements taken at 4 successive 30-minute intervals show that the buoyancy of the device has stabilized at a value at least equal to the value specified in paragraph 5.0.1.

b. *Test procedures applicable to noninflatable devices made from open cell material.* The device must be completely submerged and either supporting a human subject or attached to a mechanical apparatus that simulates the movements characteristic of a nonswimmer. During the test, the device must be subjected to a squeezing action comparable to that caused by the movements characteristic of a nonswimmer. It must be shown that the buoyancy of the device is at least equal to the value specified in paragraph 5.0.1 after testing for at least 8 hours, except that the test may be discontinued in less than 8 hours if the buoyancy measurements taken at 4 successive 30-minute intervals show that the buoyancy of the device has stabilized at a value at least equal to the value specified in paragraph 5.0.1.

7.0.2 *Salt spray testing.* All metallic operating parts must be placed in an enclosed chamber and sprayed with an atomized salt solution for a period of 24 hours. The solution must be atomized in the chamber at a rate of three quarts per 10 cubic feet of chamber volume per 24-hour period. At the end of the test period, it must be demonstrated that the parts operate properly.

7.0.3 *Flame resistance testing.* Tests must be performed on nonmetallic materials in accordance with section 6.0.2 to substantiate adequate flame resistant properties.

7.0.4 *Extreme temperature testing.* Tests must be performed to demonstrate that the device is operable throughout the temperature range specified in paragraph 5.0.3. In performing these tests, preconditioning of test specimens must be accomplished to simulate conditions of immediate use of the device following an aircraft takeoff.

NOTE: An acceptable procedure for preconditioning may involve storage of the device for 8 hours at the extreme temperatures specified, followed by exposure to room temperature conditions for a period of time not to exceed 10 minutes.