FEDERAL AVIATION AGENCY

Washington 25, D. C.

TECHNICAL STANDARD ORDER

Regulations of the Administrator

Part 514

SUBJECT: **LIFE RAFTS (TWIN TUBE)** **TSO-C12c**

Technical Standard Orders for Aircraft Materials, Parts, Processes, and Appliances

Part 514 contains minimum performance standards and specifications of materials, parts, processes, and appliances used in aircraft and implements the provisions of sections 3.18, 4a.31, 4b.18, 6.18 and 7.18 of the Civil Air Regulations. The regulation uses the Technical Standard Order system which, in brief, provides for FAA-industry cooperation in the development of performance standards and specifications which are adopted by the Administrator as Technical Standard Orders, and a form of self-regulation by industry in demonstrating compliance with these orders.

Part 514 consists of two subparts. Subpart A contains the general requirements applicable to all Technical Standard Orders. These provisions are summarized below for the convenient reference of the public. Subpart B contains the technical standards and specifications to which a particular product must conform, and each Technical Standard Order is set forth in the appropriate section of Subpart B. The subject Technical Standard Order is printed below. ANY TECHNICAL STANDARD ORDER MAY BE OBTAINED BY SENDING A REQUEST TO FAA, WASHINGTON 25, D. C.

SUBPART A--GENERAL

This subpart provides, in part, that a manufacturer of an aircraft material, part, process, or appliance for which standards are established in Subpart B, prior to its distribution for use on a civil aircraft of the United States, shall furnish a written statement of conformance certifying that the material, part, process, or appliance meets the applicable performance standards established in this part. The statement of conformance must be signed by a person duly authorized by the manufacturer, and furnished to the Chief, Engineering and Manufacturing Division, Bureau of Flight Standards, Federal Aviation Agency, Washington 25, D. C.

Subpart A also requires appropriate marking of materials, parts, processes, and appliances as follows:

(a) Name and address of the manufacturer responsible for compliance,

(b) Equipment name, or type or model designation,

(c) Weight to the nearest pound and fraction thereof,

(d) Serial number and/or date of manufacture, and

(e) Applicable Technical Standard Order (TSO) number.

In addition, Subpart A provides that no deviation will be granted from the performance standards established in Subpart B, and that the Administrator may take appropriate action in the event of noncompliance with Part 514.

SUBPART B

§ 514.22 Life rafts (twin tube)--TSO-C12c--(a) Applicability--(1) Minimum performance standards. Minimum performance standards are hereby established for life rafts (twin tube) which specifically are required to be approved for use on civil aircraft of the United States. New models of life rafts manufactured on or after October 15, 1959, shall meet the standards set forth in the ATA Specification No. 800, "Airline Life Rafts," dated May 1, 1958,[1/] with the additional requirements shown in subparagraph (2) of this paragraph, and the exceptions listed in subparagraph (3) of this paragraph. Life raft models approved by the Administrator prior to May 17, 1961, may continue to be used under the provisions of their original approval until they are no longer seaworthy.

(2) Additional requirements. The degree of inflation shall be such that the raft will be "rounded-out" (i.e., attain its design shape and approximate dimensions) to be able to receive the first occupant within one minute after the start of inflation. Thereafter, inflation during boarding by the remainder of occupants shall be sufficient to ensure a serviceable and rigid raft.

(3) Exceptions. For the purpose of this section, conformance is not required with the provision of Section 4.2.8 of ATA Specification No. 800 that the length of the installed gas release cables be identical and not exceed 30 inches.

(b) Marking. In lieu of the marking requirements specified by Subpart A, the marking instructions contained in ATA Specification No. 800 shall be acceptable and, in addition, each life raft shall be permanently marked with the Technical Standard Order designation, FAA-TSO-C12c, to identify the life raft as meeting the requirements of this section.

(c) Data requirements. (1) One copy each of the manufacturer's operation and inflation instructions, schematic diagrams, and installation procedures shall be furnished the Chief, Engineering and Manufacturing Division, Bureau of Flight Standards, Federal Aviation Agency, Washington 25, D. C., with the statement of conformance.

(2) The raft manufacturer must also provide the purchaser with applicable limitations pertaining to installation of rafts on aircraft. These limitations shall include the minimum and maximum stowage area temperatures and any other limitations which will prevent the raft from performing its intended function and complying with the minimum performance standards under all reasonably foreseeable emergency conditions.

(d) Effective date. May 17, 1961.

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opies may be obtained from the Air Transport Association, 1000 Connecticut venue, N. W., Washington 6, D. C.

SPECIFICATION

AIRLINE LIFE RAFTS

ATA SPECIFICATION NO. 800

May 1, 1958

AIR TRANSPORT ASSOCIATION OF AMERICA

AIR TRANSPORT ASSOCIATION OF AMERIC
SPECIFICATION -- AIRLINE LIFE RAFTS

1. APPLICABLE SPECIFICATIONS

1.1 The following specifications shall by references hereinafter noted form a part of this specifications and shall include the latest revisions at the time of manufacture or, in the event that any are cancelled or superseded, the revision of the specification last in effect shall apply.

1.1.1 U. S. Military Specifications

MIL-R-9131A	Raft, Pneumatic Type F-2A
MIL-C-6819A	Cloth, Cotton, Coated
MIL-I-18369	Inflation Equipment, Carbon Dioxide, for Multiplace Life Rafts
MIL-A-3339	Anchor, Sea

1.1.2 Federal Specifications

QQ-M-151a	Metals, General Specification, for Inspection of
~~MIL-C-6819~~ ZZ-R-601	Federal Test Method No. 601, Rubber Sampling and Testing
CCC-T-191b	Textiles, General Specification, Test Methods
FED. STD. #595	Colors

1.1.3 American Society for Testing Materials

ASTM-D573-53	Method of Test for Accelerated Aging of Vulcanized Rubber by the Oven Method
ASTM-D751-52T	Methods of Testing Rubber Coated Fabrics

2. TYPE

2.1 This specification covers minimum basic design, performance and safety requirements for all types of airline life rafts suitable for commercial overwater use.

3. MATERIALS AND WORKMANSHIP

3.1 Non-metallic Materials

3.1.1 The rafts shall be constructed in a throughly workmanlike manner. The finished rafts shall be clean and free from any defects that might affect function or appearance.

3.1.2 All non-metallic fabricated raw materials and components used in the manufacture of life rafts, shall have been manufactured not more than 18 months prior to the date of delivery of the finished product.

3.1.2.1 Coated Fabrics, General: All coated fabrics used in the manufacture of life rafts shall possess at least 90% of the physical properties called for under their applicable specifications after these coated fabrics have been subjected to an accelerated aging test in accordance with ASTM-D573-53.

3.1.2.1.1 Flotation Chambers: Coated fabrics used for this application shall conform to the following minimum test specifications (per ASTM-D751-52T):

Tensile Strength: (Grab Test) Warp 190 lbs./in.(min)
Fill 190 lbs./in.(min)

Tear Strength: (Trapezoidal Method) 13 x 13 lbs./in (min)

Permeability: Permeability to Helium of not more than 10 ltrs. per square meter per 24 hours at + 77 degrees F.(Max.)

Ply and Coat Adhesion: 5 lbs. per inch width

3.1.2.1.2 Deck: Coated fabrics used for this purpose shall be waterproof and shall conform to the following minimum specifications:

Tensile Strength: (Grab Test) Warp 190 lbs./in.
Fill 190 lbs./in.
Tear Strength: (Trapezoidal Method) 13 x 13 lbs./in.

Ply and Coat Adhesion: 5 lbs. per inch width.

3.1.2.1.3 Canopy: Coated fabrics used for this purpose shall be water proof and shall not affect potability of collected water, and shall conform to the following minimum specifications:

Tensile Strength: (Grab Test) Warp 75 lbs. per inch.
Fill 75 lbs. per inch.

Tear Strength: (Trapezoidal Method) 4 x 4 lbs. per in.

Coat Adhesion: 3.5 lbs per inch width

3.1.2.1.4 Seam Tape: Tape used for the purpose of reinforcement of seams shall meet specification MIL-R-9131A.

3.1.3 Seam Strength and Adhesives: Seams and adhesives used in the manufacture of life rafts shall develop the following minimum strength:

Load Test - Seam Strength (3/4 in. Overlap, Maximum; 2 in. width, Maximum)
At 75 degrees F. 350 lbs. @ 12 in./min.
At 140 degrees F. 80 lbs. @ 12 in./min.

Peel Test - Seam Strength - The seam shall have a peel strength of 5 lbs. per inch width at normal room temperature (approximately 70°F.) at 2 in./min.

Samples of seams shall retain at least 90% of the above values after having been subjected to an accelerated aging test in accordance with specification ASTM D573-53.

3.1.4 Molded Non-Metallic Fittings: Materials used for this purpose shall retain their operational characteristics when subjected to temperatures of -65 to +160 degrees F.

3.2 Metallic Parts

All metallic parts shall be corrosion resistant or suitably protected against corrosion.

3.2.1 Standard Parts: Standard parts (MS, AN, or JAN) shall be used wherever they are suitable for the purpose. Commercial utility parts such as screws, bolts, nuts, cotter pins, etc., may be used, provided they possess suitable properties and are replaceable by the standard parts (MS, AN, or JAN) without alteration, and provided the corresponding standard part numbers are referenced in the parts list. In the event there is no suitable corresponding standard part, commercial parts may be used provided they conform to all requirements of this specification.

3.2.2 Protection: All flotation chambers and floor shall be protected in such a manner that non-fabric parts shall not cause chafing or abrasion in either the packed or inflated condition.

4. DETAIL REQUIREMENTS

4.1 Design and Construction

4.1.1 Shape: The raft shall be circular in shape unless it can be demonstrated that another shape is of satisfactory stability.

4.1.2 Size: The rated standard sizes shall be 10, 15, 20 and 25 man rafts with a usable sitting area on the floor of not less than 3.6 sq. ft. per person for rated capacity and 2.4 sq. ft. per person for maximum capacity.

4.1.3 Number of Tubes: The raft shall have at least two identical flotation tubes, one superimposed on the other.

4.1.4 Floor: The raft shall have a floor which shall be adequately mounted to the inflation tubes and shall have incorporated inflatable buoyancy chamber(s) attached thereto. The floor shall be mounted in such a way to permit reversibility of the raft.

4.1.5 Buoyancy: The minimum buoyancy per person shall be 250 pounds, based on the tubes only, (disregarding the buoyancy derived from the floor or the inflatable floor support). Minimum free-board shall be 12 inches for all rafts herein considered, utilizing buoyancy of the complete raft allowing 170 pounds per person. The entire periphery of both main flotation chambers shall be self-inflated to the pressure outlined in paragraph 4.1.6 of this specification.

4.1.6 Inflation: One cylinder meeting I.C.C. requirements shall be provided to inflate properly each main flotation chamber. Tubes shall be inflated to a pressure of not less than 1½ psi and not more than 2 psi at a corrected temperature of 70°F. and at corrected standard atmospheric pressure. Inflation equipment shall be located on outside periphery of raft at a point diametrically opposite the midway point between the primary boarding aids. Arrangement shall be such that failure of one tube or manifold will not allow loss of gas in other tube or tubes. No sealing material which will harden or obstruct the gas or air passage shall be used. All main structural tubes of the raft shall be fully inflated from the main inflation system. An exception is granted for replacement of rafts for special aircraft compartments designed and in use as of the effective date of this specification, provided such compartments will not accommodate the cylinder requirements specified herein and provided such replacements conform to all other provisions of this specification.

If a high pressure air bottle and an aspirator are used for inflation of the raft, the air bottle shall conform to I.C.C. regulations. The aspirator shall have a quick opening one-way valve for inflation and have a positive gas seal assisted by back pressure when closed, plus a protective screen covering the aspirator opening to preclude ingestion of objects which may prevent the positive seating of the gas seal.

4.1.7 Primary Boarding Aids: At least one primary boarding aid(s) which will permit the unassisted entry from the water into the unoccupied raft shall be provided. Such aid(s) shall be effective in either floating position of the raft. Primary boarding aids shall not at any time impair the rigidity of the raft nor its inflation characteristics.

4.1.8 Secondary Boarding Aids: In relation to the primary aid(s), boarding handles and/or stirrups shall be provided suitably located to best assist persons entering the raft from the water. They shall be designed to withstand a pull of 500 pounds each.

4.1.9 Life Line: A life line of contrasting color of at least 3/4" nylon webbing, which can be easily grasped and which will not appreciably change its shape when wet, shall encircle the raft on the outside periphery. It shall be useable with the raft floating either side up. It shall be attached to the raft at intervals by means of knots at the webbing loops (or equivalent). The life line and attaching raft loops shall be capable of withstanding a minimum load of 500 pounds.

4.1.10 Manual Inflation Valves: Non-metallic friction fit type valves with a 5/8" minimum inside diameter opening shall be located so as to permit pump inflation of all tubes from either side. Must not interfere with occupant comfort.

4.1.11 Color: The color of all exposed surfaces of the raft shall be orange-yellow, Color No. 3305, conforming to Specification TT-C-595 (U.S. MIL-R-9131A) or equivalent high-visibility color.

4.1.12 Grasp Line: A Grasp Line, identical to the life line and secured at appropriate intervals shall be attached to the top inside quarter of each inflation tube approximately midway between the horizontal and vertical centerlines of the tube. Sufficient slack in the grasp line should be provided to permit the occupants to steady themselves when seated on the raft deck with their backs to the main tube. The grasp line shall be incapable of contributing to strangulation of the raft during inflation.

4.2 Accessory Equipment

Note: All lines shall be suitably stowed and secured to prevent entanglement during launching of raft.

4.2.1 Raft Mooring Line: A suitable mooring line with a wet breaking strength of 450-550 pounds and with a minimum length of 20 ft. shall be provided. One end shall be attached to the raft at the point of intersection of the tubes on the outer periphery of the raft with the rest of the line held flaked to the carrying case (See 4.2.8 below). The strength of the attachment ot the raft shall be in excess of the strength of the line.

Note: This line is considered as being the static line required by CAR 4.b.645(a).

4.2.2 Sea Anchor: A Type 2 sea anchor conforming to MIL-A-3339 shall be provided. The method of attachment shall minimize abrasion of the line at its attaching point. A point of attachment of suitable strength (not less than 500 lbs.) for the attachment of a sea anchor shall be provided on the tube intersection line diametrically opposite the midway point between the primary boarding aid(s).

4.2.3 Heaving-Trailing Line: At least one floating heaving trailing line not less than 75 ft. in length and with a tensile strength of not less than 250 lbs. containing a flotable device of suitable size and weight, shall be located on the main flotation tube(s) near the sea anchor attachment and shall be accessible from either side of the raft.

Note: This line is considered as being the trailing line required by CAR 4.b.645(a).

4.2.4 Canopy: A one-piece over-all cover shall be provided which shall have provisions for openings 180° apart for two-way cross-ventilation. The canopy (overall cover) shall have access openings that may be varied and fixed for ventilation or completely sealed. It shall be easily detachable from periphery of raft. Minimum attachment provisions shall be incorporated to permit the canopy to be installed on either side of the raft. Provisions all be made for supporting the canopy both around the periphery of the raft and in the center sufficiently high to clear the heads of the occupants in a sitting position. Canopy color shall comply with paragraph 4.1.11 of this specification. A closable outlet shall be provided at the center of the canopy to permit controlled trapping of rain water. The erected canopy shall withstand 40 mile winds and gusts up to 60 mph in open water.

4.2.5 Inflation Pump: The pump shall be in accordance with or superior to the latest revision of the applicable Army-Navy specification for Pumps; Hand Air, insofar as performance, strength, general design, finish and materials are concerned. One pump shall be provided, and it shall be suitably attached to the raft to prevent loss, either when stowed or in use. Pump stowage shall permit compact raft packing and easy access when the raft is afloat. The pump outlet shall conform with the friction type valve specified in paragraph 4.1.10 of this specification.

4.2.6 Accessory Case Tie-Downs: Provisions shall be made on each side of the floor near the center of the raft for tie-downs to hold the accessory case. Each tie-down shall be capable of withstanding a pull of 250 pounds.

4.2.7 Carrying Case: A carrying case fitting the packaged (folded) raft properly shall be provided for each portable life raft. If of fabric construction, it shall be of international orange color.

4.2.7.1 Material for the carrying case shall be fungus-proof, oil resistant and non-chafing. The case shall be provided with handles so it may be carried by one person, two persons in tandem or dragged by either end. None of these carrying operations shall tend to pull the case open. Each handle shall be at least six inches long and its strength must be at least four times the total weight of the raft and case.

4.2.7.2 The carrying case shall not employ conventional zippers for closing. The entire closing ends shall have at least a four (4) inch dust flap extended into the carrying case. The design of the carrying case opening and positioning of the fasteners shall permit rapid cover opening.

4.2.8 Raft Launching Equipment: A parachute rip-cord grip and fabric retaining pocket, similar to current AN types, shall form the primary inflation control. The rip-cord grip shall have a minimum strength of 500 pounds. The rip-cord grip shall be adaptable for the attachment of a positive method of securing to the airframe. The rip-cord grip position shall be standardized. When facing the release end of the carrying case, the center line of the retaining pocket shall lie at 45 degrees in the right upper quadrant of the end section. The outermost extremity of the rip-cord grip shall not extend beyond the outer margin of the carrying case. The rip-cord grip shall serve both to retain the raft by means of a line and to actuate the gas releases. The length of the installed gas release cables shall be identical and shall not exceed thirty (30) inches. The tension required to withdraw the mooring line and to actuate the gas release mechanisms shall be between 20 and 30 pounds. The strength of the gas release cables, their fittings and their attachments shall be no less than 500 pounds.

See exception (3)

4.2.9 Sampling Test Strips: Two 6" x 10" sampling test strips of the same fabric used in raft tube construction shall be attached to the raft. These strips shall be suitably identified and shall be permanently attached at the ends only so that a test specimen can be removed without damage to the raft. The edges of the test strips shall be sealed when initially installed and after each specimen is removed.

4.2.10 Knife: A hook type knife, secured by means of a retaining line shall be provided with each raft. The knife shall be sheathed in a knife pocket which shall be cemented to the raft adjacent to the point of mooring line attachment.

4.3 Marking Instructions

4.3.1 Raft Identification: Each raft shall be legibly and permanently marked with the following information:

a. Manufacturer's Name
b. Manufacturer's Model and Serial Number
c. Air Transport Association Specification Number (ATA 800)
d. Date of Fabric Manufacture (month and year)
e. Date of Raft Manufacture (month and year)
f. Rated Capacity

4.3.2 Placarding Instructions: Suitable placarding in waterproof paint in contrasting colors which is not detrimental to the fabric, shall denote use and location of raft equipment and boarding aids; letters in the placards denoting location of boarding aids and equipment shall be at least 2" high. Placarding shall take into account possible occupancy of either side of raft as well as persons boarding raft from water.

4.4 Tests

4.4.1 Responsibility: Manufacturer will be responsible for keeping records a minimum of seven years of all his inspection work and tests, giving results of test required to determine compliance with the requirements and tests specified herein. These records shall be kept complete and shall be available to the CAA or purchaser's representative at all times. Manufacturers not having laboratory testing facilities shall engage the services of a commercial testing laboratory capable of conducting tests to determine compliance with all the requirements and tests in this specification.

4.4.2 The following tests shall be applied to each raft manufactured:

4.4.2.1 Special Tests: Representative samples not less than 1/2 yard shall be cut at each end at the approximate center of every continuous roll of approximately 100 yards length of the coated fabric used in the construction of the raft and its components, and the same shall be subjected to the following tests described herein fter:

a. Permeability (where required)
b. Ply and Coating Adhesion
c. Tensile Strength
d. Tear Strength

All of the tests called for under this paragraph shall be performed not more than 30 days prior to the cutting of the material. Tests on each roll of fabric shall be serialized and notations made on the in-process inspection record of each raft of said numbers.

4.4.2.2 Flotation Chambers and Boarding Aids: Each chamber and inflated boarding aid shall be inflated with oil free air to a pressure of 2.00 psig. At the end of one hour, the pressure shall be checked and adjusted to 2.00 psig, if necessary. At the end of 24 hours, the pressure shall be checked and adjusted for ambient temperature and, if found to be not less than 1.50 psig, the flotation chambers and boarding aids shall be considered satisfactory.

4.4.2.3 Center Floor Support: Each center floor support shall be inflated with oil free air to a pressure of 1.00 psig. At the end of one hour, the pressure shall be checked and adjusted to 1.00 psig, if necessary. At the end of 24 hours, the pressure shall be checked and adjusted for ambient temperature and if found to be not less than 0.5 psig the floor support shall be considered satisfactory.

4.4.2.4 Overpressure: Each raft compartment, excluding the floor supports, shall be subjected to an inflation pressure test of 4.00 psig for not less than 5, nor more than 10, minutes. Overpressure tests shall be conducted simultaneously on raft chambers on the same side of the raft floor.

4.4.3 The following tests are required for initial qualification:

4.4.3.1 Functional Tests: A new model* raft shall pass the functional tests stated below. A previously approved model of a raft modified in such a manner that its performance characteristics, such as buoyancy, inflation, seaworthiness, boarding, and packing are changed, shall be subjected to such of the following tests as are necessary to assure that there is no adverse effect on performance as a result of the modification.

*A new model is one which:
a. Has never been previously accepted as conforming to this specification

b. Was a previously approved model but which has been subsequently redesigned to such an extent that all or only a portion of the performance tests must be conducted in order to substantiate the redesign.

4.4.3.1.1 Raft Static Inflation: The complete raft package shall be inflated by means of the installed inflation equipment at room temperature (70° F) at sea level. The raft shall assume a well-rounded condition in a maximum of 30 seconds and at the end of one hour, the raft shall meet the design requirements of this specification for both pressure and volume. This same test shall be performed on a raft selected at random from each lot of 25 or fraction thereof being manufactured. This raft may be used to conduct the over pressure proof test, paragraph 4.6.

4.4.3.1.2 Carrving Case: It shall be demonstrated for at least 10 times that the carrying case will open satisfactorily and cause no delay in the inflation and deployment of the raft.

4.4.3.1.3 Gas Cylinder Releases: It shall be demonstrated that pulling the rip-cord grip from any position will actuate all primary gas cylinder releases.

4.4.3.1.4 Raft Design: The raft shall demonstrate in water that the boarding aids are adequate for the purpose intended, that they do not impair rigidity of the raft, and that it is possible to board the raft using the boarding aids without any assistance. It shall also be demonstrated that the canopy can be satisfactorily erected using only the items supplies in the kit. The demonstration shall also show that the life raft folded and packed in accordance with the manufacturer's instructions will deploy satisfactorily and inflate in a normal manner when the release mechanism is actuated.

4.4.3.1.5 Raft Drop Test: A complete raft package shall be dropped or thrown from a height of 5 feet onto a bare floor to demonstrate that no failure or malfunction in the inflation system will occur and that the raft will inflate satisfactorily.

4.4.3.1.6 Aspirator Inflated Raft Test(s): It shall be demonstrated that the complete raft package when thrown into water in any attitude shall right itself in such a manner that during inflation the amount of water ingestion will be inconsequential.

4.4.3.2 Salt Spray: All metal parts shall operate satisfactorily and shall not corrode when subjected to a salt spray in accordance with Federal Specification QQ-M-151a for a period of 100 hours.

4.4.3.3 Temperature Exposure: The packed raft shall be exposed to a temperature not higher than -65°F and to a temperature of not lower than 160°F. The raft shall remain at each temperature for not less than 24 hours and shall be inflated within 5 minutes after removal from each temperature exposure. The raft shall be allowed to return to a temperature of approximately 70°F before being repacked and subjected to the second exposure. The raft shall be inflated by means of gas cylinders which have not been exposed to the test temperatures. After the raft has been exposed to the above temperatures, it shall be able to pass tests called for under paragraph 4.4.2.2, 4.4.2.3, 4.4.2.4 and 4.4.3.1 of this specification.

4.5 Over Pressure Proof Test: One raft shall be selected at random from each lot of 25 or fraction thereof being manufactured and subjected to an overpressure proof test of 6.00 psig for not less than 5 nor more than 10 minutes. Overpressure proof test shall be conducted simultaneously on the same side of the raft floor. Rafts so tested shall be identified to the customer prior to sale.

4.6 Test Methods:

4.6.1 Rubber Goods: Methods for testing rubber goods called for in this specification shall be per Federal Specification ZZ-R-601.

4.6.2 Textiles: Methods for testing textiles called for in this specification shall be per Federal Specification CCC-T-191b.

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