



AEROSPACE RECOMMENDED PRACTICE

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LIFE RAFTS

1. PURPOSE

This Aerospace Recommended Practice (ARP) establishes criteria for the design and performance of aircraft life raft devices which will ensure their rapid and effective use as a flotation device in a water landing. This document is not intended to specify particular design methods, mechanisms, or equipment to be used to accomplish the objectives established herein.

2. GENERAL RECOMMENDATIONS

- 2.1 The life raft and its associated equipment shall be designed to function as a sea-worthy survival platform within the loading, operational, and environmental constraints established in the following sections.
- 2.2 The life raft and its equipment shall be designed to (1) minimize the possibility of catastrophic failure of any raft system component, and (2) minimize the effect of such failure on the raft's primary function as a survival platform.
- 2.3 The life raft and its equipment shall be designed to minimize the possibility of occupant injury and to maximize occupant survivability in all flotation modes.
- 2.4 The raft equipment specified in Section 4 shall be readily available to occupants in all flotation modes, if the raft is reversible.
- 2.5 The life raft shall be completely reversible to the extent that its utility and safety in any floating attitude is equivalent, or, if not reversible, it must be self-righting or have sufficient righting aids to enable one swimmer to right the raft in calm water to its proper attitude. For rafts in other than the design flotation attitude(s), sufficient passive flotation assistance (such as life/grasp lines) shall be provided to accomodate the number of persons equal to the raft's overload capacity.
- 2.6 Secondary structural members, such as inflatable canopy supports, secondary flotation chambers, inflatable boarding aids, and inflatable floor, shall be independent of the primary flotation chambers to the extent that puncture of these members will not compromise the bouyancy of the primary flotation chambers.
- 2.7 The attachment of all lines and equipment to the life raft shall be designed such that the failure of these attach points will not compromise the integrity of primary flotation chambers; the strength of line attach points shall be at least the recommended line knotted strength unless specified otherwise.
- 2.8 A means for the collection and storage of rain water shall be provided.

3. DETAILED RECOMMENDATIONS - LIFE RAFT GENERAL

3.1 Operational/Environmental Considerations:

- 3.1.1 The life raft device shall be capable of inflating to a boardable configuration in 15 sec. no longer than five minutes after being removed from the following environmental extremes:

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- 3.1.1.1 Ambient temperature of $32^{\circ}\text{F} \pm 5^{\circ}$ ($0^{\circ}\text{C} \pm 2.8^{\circ}$) after stabilization at -40°F (-40°C) for no less than 30 minutes.
- 3.1.1.2 Ambient temperature of $100^{\circ}\text{F} \pm 5^{\circ}$ ($37.8^{\circ}\text{C} \pm 2.8^{\circ}$) after stabilization at $+160^{\circ}\text{F}$ ($+71^{\circ}\text{C}$) for no less than 30 minutes.
- 3.1.2 The device and its equipment shall be capable of withstanding storage for 24 hrs without damage at stabilized temperatures of -65°F (-53.9°C) and $+160^{\circ}\text{F}$ ($+71^{\circ}\text{C}$). The device and its equipment shall be capable of withstanding storage for 24 months at a temperature environment that fluctuates periodically within those temperature limits.
- 3.1.3 The raft shall be sea-worthy at any loading between 50% and normal rated capacity in sea conditions of 27 knot winds and waves of 10 feet (3 meters).
- 3.1.4 The raft and its equipment shall be capable of withstanding a salt water, marine environment with exposure to ozone and ultra-violet radiation for a period of at least 15 days.
- 3.1.5 The raft and its equipment shall be capable of withstanding temporary exposure to aircraft fuels and fluids while in a marine environment (as might be expected during a ditching) for eight hrs without compromising function or operation.
- 3.1.6 The raft and its equipment shall be rot, mildew, fungus, and corrosion resistant.

3.2 Buoyancy:

- 3.2.1 Buoyancy shall be provided by a minimum of two independent flotation chambers capable of supporting the rated and overload capacities in fresh water with the following freeboard constraints:
 - 3.2.1.1 Twelve in. (30 cm) of freeboard at rated capacity with all primary flotation chambers inflated to design pressure.
 - 3.2.1.2 Six in. (15 cm) of freeboard at rated capacity with the critical flotation chamber deflated and the remaining primary chambers at design pressure.
 - 3.2.1.3 Measurable freeboard at overload capacity with most critical flotation chamber deflated and the remaining primary chambers at design pressure.

NOTE: An average occupant weight of 170 lb (77 kg) is assumed.

3.3 Capacity Ratings:

- 3.3.1 The normal rated capacity of the raft shall be determined as the number of persons that can be accommodated within the inner periphery of the life raft structure, given that each occupant is provided a minimum width of 15 in. (38 cm) of raft structural back support and 3 sq. feet (0.28 m^2) of floor space.
- 3.3.2 The maximum (overload) rated capacity shall be determined by demonstration as the nearest whole number of occupants to the value of 1.25 times the rated capacity provided the requirements of 3.2 are met.

3.4 Inflation System:

- 3.4.1 The inflation system shall meet all applicable regulatory specifications and shall be capable of meeting all performance/environmental criteria specified in this ARP.
- 3.4.2 Each primary flotation chamber shall be provided an independent inflation system. Failure of any one or combination of inflation systems shall not compromise the function of the remaining systems.
- 3.4.3 Activation of the primary inflation system(s) shall be accomplished by a single action with a single device.

- 3.4.4 The inflation system(s) shall incorporate an automatic pressure venting/bleeding mechanism to prevent inadvertent inflation of the raft or its carrying case due to storage system leakage during stowage.
- 3.4.5 Each primary inflation chamber shall be provided with a means of manual inflation by mechanical pump. For reversible rafts, access to manual inflation valves must be provided in each flotation mode. The valves shall be of the nonreturn type.
- 3.4.6 Each primary flotation chamber shall be provided with a pressure relief system set at the appropriate pressure to ensure satisfactory operation within the operational environments specified in 3.2.
- 3.4.7 Aspirated inflation systems shall be designed such that:
 - 3.4.7.1 A positive gas seal is provided at zero pressure differential.
 - 3.4.7.2 Aspirator leakage in any raft attitude or in any environmental situation suggested by this ARP is precluded.
 - 3.4.7.3 The aspirator inlet will not open when exposed to heavy sea action and will be protected from the impingement of foreign objects.
- 3.4.8 The inflation handle shall be similar to the standard parachute-type handle or "rip cord" grip; the static pull force required to activate all primary inflation systems shall be 25 lb $\pm$ 5 over the designed operating temperature range.
- 3.4.9 The inflation handle shall be positioned on the outside of the raft's immediate container in a readily identifiable retention pocket designed to preclude snagging of the handle in stowage or portage. This pocket shall be located on either end of the carrying case with its center line position in the right upper quadrant of the end section. The outermost extremity of the inflation handle shall not extend beyond the outer margin of the carrying case when stowed in the pocket.

3.5 Raft Package/Protection:

- 3.5.1 The raft shall be provided with a durable, chafe and puncture resistant protective carrying case properly fitting the raft body; it shall be of a highly visible color and appropriately marked as to its contents and function. The material and construction of the carrying case shall be resistant to fungus, rot, and the environmental conditions specified in this ARP.
- 3.5.2 The raft, packaged in the carrying case, shall be capable of withstanding a drop of ten ft (3 m) onto a hard surface without adversely affecting the performance criteria established in this ARP.
- 3.5.3 The packaged life raft shall have positive bouyancy in fresh water.
- 3.5.4 Design and configuration of the raft envelope and the carrying case shall facilitate portage and deployment in an aircraft cabin environment; particular consideration shall be given to such items as aircraft emergency exit configurations, aisle widths, and raft storage configurations.
- 3.5.5 The carrying case shall be provided with easily distinguishable carrying handles that will facilitate portage by a single individual as well as two. The design of the case shall be such that portage in any mode will not allow inadvertent opening of the case. The use and location of all carrying handles shall be self-evident. Individual handle strength shall exceed four times the weight of the packaged raft.
- 3.5.6 Opening of the carrying case shall be automatic upon activation of the raft's inflation means. Opening shall not be hampered by the attitude of the packaged raft, in or out of the water. The carrying case shall not delay or impede the inflation of the raft.

3.6 Markings:

- 3.6.1 All markings on the life raft, its equipment, and its carrying case shall be of a contrasting color, durable, resistant to aircraft fuels and fluids, and shall not affect or degrade the field material.
- 3.6.2 All functions of the raft and its equipment shall be placarded on the raft structure, the equipment, or the carrying case, in the proper, affected area, and shall be visually accessible in the appropriate raft mode.

- 3.6.3 All markings relating to the recognition and location of boarding aids, inflation means, survival kit, knife, and trailing/heaving lines shall be of bold letters at least two in. (5 cm) high. Location markings shall not be placed so as to be obscured by seated occupants.
- 3.6.4 Markings indicating the location of boarding aids (and instructions for raft righting, if applicable) shall be provided at least once in each exterior quadrant of the raft and shall be readily visible by persons in the water.
- 3.6.5 Reversible rafts shall have redundant markings to accommodate both flotation modes.

4. DETAILED RECOMMENDATIONS - RAFT EQUIPMENT

4.1 Static Mooring Line:

- 4.1.1 The raft shall be provided with a static mooring line which can be attached to the aircraft during deployment/boarding. The line shall be readily accessible when the raft is in its carrying case, but must be protected from snagging during raft portage.
- 4.1.2 The knotted breaking strength of the line, the strength of any terminal fitting (or handle), and its attach point to the raft shall be 500 lb or 40 lb per rated occupant, whichever is greater, but shall be less than 1/2 the buoyancy of the fully inflated life raft.

4.2 Sea Anchor:

- 4.2.1 A sea anchor, permanently attached to the life raft and readily accessible to occupants in all flotation modes shall be provided.
- 4.2.2 The sea anchor shall be designed to maintain a normally loaded life raft with canopy erected on a substantially constant heading relative to the wind and have the ability to reduce the drift of the raft to a maximum of 2 knots in sea conditions of 27 knot winds and waves of ten feet (3 meters).
- 4.2.3 The sea anchor line shall be at least 50 ft in length and shall have a minimum knotted breakaway strength of 1000 lb. The raft attach point shall have a strength of at least 1.5 times the rated breakaway strength of the sea anchor.
- 4.2.4 The sea anchor attach point shall be located away from the static mooring line attach point or if the attach points are co-located, means must be provided to preclude confusion of the two lines and inadvertent release of the sea anchor line. The attached point shall be on the center line of the long axis of noncircular rafts. The sea anchor line, when deployed, shall not interfere with raft boarding areas.

4.3 Canopy:

- 4.3.1 A water and wind resistant canopy which is capable of covering the entire occupiable portion of the life raft shall be provided. It shall be supported above the heads of seated occupants.
- 4.3.2 The canopy shall be of highly visible color.
- 4.3.3 The canopy shall be capable of withstanding sea conditions of 27 knot winds and waves of ten ft (3 m) when erected.
- 4.3.4 If manually erected, the canopy and associated hardware shall be designed such that erecting procedures are self-evident, and simple.
- 4.3.5 As a minimum the canopy shall be provided closable openings at each of the boarding stations and adjacent to the static line attach point. These openings shall be at least 39.4 in. (1 m) wide and sufficiently high to permit unrestricted boarding of an adult with life preserver donned. Canopy opening closures shall be from the bottom up, and shall be resistant to jamming and corrosion. The openings shall provide cross ventilation of the raft interior.