

in accordance with Figure 4b-22, and such knobs shall be of the same color, but of a color in contrast with that of not only the other control knobs but also the surrounding cockpit.

Note: Figure 4b-22 is not intended to indicate the exact size or proportion of the control knob.

(g) Where the work load on the flight crew is such as to require a flight engineer (see § 4b.730), a flight engineer station shall be provided. The station shall be so located and arranged that the flight crew members can perform their functions efficiently and without interfering with each other.

§ 4b.354 *Instrument arrangement.* (See § 4b.611.)

§ 4b.355 *Instrument markings.* (The operational markings, instructions, and placards required for the instruments, controls, etc., are specified in §§ 4b.730 through 4b.738.)

§ 4b.356 *Doors.* (a) Airplane cabins shall be provided with at least one easily accessible external door.

(b) Means shall be provided for locking each external door and for safeguarding against opening in flight either inadvertently by persons or as a result of mechanical failure. It shall be possible to open external doors from either the inside or the outside even though persons may be crowding against the door from the inside. The means of opening shall be simple and obvious and shall be so arranged and marked that it can be readily located and operated even in darkness.

(c) Reasonable provisions shall be made to prevent the jamming of any external door as a result of fuselage deformation in a minor crash.

(d) External doors shall be so located that persons using them will not be endangered by the propellers when appropriate operating procedures are employed.

(e) Means shall be provided for a direct visual inspection of the locking mechanism by crew members to ascertain whether all external doors, including passenger, crew, service, and cargo doors, are fully locked (see also § 4b.362 (e) (5) for emergency exits). In addition, visual means shall be provided to signal to appropriate crew members that all normally used external doors are closed and in the fully locked position.

§ 4b.357 *Door louvers.* Where internal doors are equipped with louvers or other ventilating means, provision convenient to the crew shall be made for stopping the flow of air through the door when such action is found necessary.

§ 4b.358 *Seats, berths, and safety belts—(a) General.* At all stations designated as occupiable during take-off and landing, the seats, berths, belts, harnesses, and adjacent parts of the air-

and crew shall be afforded protection from head injuries by one of the following means:

(i) Safety belt and shoulder harness which will prevent the head from contacting any injurious object.

(ii) Safety belt and the elimination of all injurious objects within striking radius of the head.

(iii) Safety belt and a cushioned rest which will support the arms, shoulders, head, and spine.

(2) For arrangements which do not provide a firm hand hold on seat backs, hand grips or rails shall be provided along aisles to enable passengers or crew members to steady themselves while using the aisles in moderately rough air.

(3) All projecting objects which would cause injury to persons seated or moving about the airplane in normal flight shall be padded.

(c) *Strength.* All seats and berths and their supporting structure shall be designed for occupant weight of 170 pounds with due account taken of the maximum load factors, inertia forces, and reactions between occupant, seat, and safety belt or harness corresponding with all relevant flight and ground load conditions, including the emergency landing conditions prescribed in § 4b.260. In addition, the following shall apply.

(1) Pilot seats shall be designed for the reactions resulting from the application of pilot forces to the flight controls as prescribed in § 4b.224.

(2) In determining the strength of the seat or berth attachments to the structure, and the safety belt or shoulder harness attachments to the seat, berth, or structure, the inertia forces specified in § 4b.260 (a) shall be multiplied by a factor of 1.33.

§ 4b.359 *Cargo and baggage compartments.* (See also §§ 4b.382 to 4b.384.)

(a) Each cargo and baggage compartment shall be designed for the placarded maximum weight of contents and the critical load distributions at the appropriate maximum load factors corresponding with all specified flight and ground load conditions, excluding the emergency landing conditions of § 4b.260.

(b) Provisions shall be made to prevent the contents in the compartment from becoming a hazard by shifting under the loads specified in paragraph (a) of this section.

(c) Provisions shall be made to protect the passengers and crew from injury by the contents of any compartment, taking into account the emergency landing conditions of § 4b.260.

#### EMERGENCY PROVISIONS

§ 4b.360 *General.* The requirements of §§ 4b.361 and 4b.362 shall apply to the emergency provisions.

§ 4b.361 *Ditching.* Compliance with this section is optional. The requirements of this section are intended to

is certificated to include ditching provisions, the recommended ditching procedures established on the basis of these requirements shall be set forth in the Airplane Flight Manual (see § 4b.742 (d)).

(a) All practicable design measures compatible with the general characteristics of the type airplane shall be taken to minimize the chance of any behavior of the airplane in an emergency landing on water which would be likely to cause immediate injury to the occupants or to make it impossible for them to escape from the airplane. The probable behavior of the airplane in a water landing shall be investigated by model tests or by comparison with airplanes of similar configuration for which the ditching characteristics are known. In this investigation account shall be taken of scoops, flaps, projections, and all other factors likely to affect the hydrodynamic characteristics of the actual airplane.

(b) It shall be shown that under reasonably probable water conditions the flotation time and trim of the airplane will permit all occupants to leave the airplane and to occupy the life rafts required by § 4b.645. If compliance with this provision is shown by buoyancy and trim computations, appropriate allowances shall be made for probable structural damage and leakage.

Note: In the case of fuel tanks which are equipped with fuel jettisoning provisions and which can be reasonably expected to withstand a ditching without leakage, the jettisonable volume of fuel may be considered as buoyancy volume.

(c) External doors and windows shall be designed to withstand the probable maximum local pressures, unless the effects of the collapse of such parts are taken into account in the investigation of the probable behavior of the airplane in a water landing as prescribed in paragraphs (a) and (b) of this section.

§ 4b.362 *Emergency evacuation.* Crew and passenger areas shall be provided with emergency evacuation means to permit rapid egress in the event of crash landings, whether with the landing gear extended or retracted, taking account of the possibility of the airplane being on fire. The provisions of this section shall apply to airplanes where the major portion of the passenger area is aft of the powerplant and the fuel tanks. In airplanes where the major portion of the passenger area is forward of the powerplant and the fuel tanks, or in airplanes of unconventional design where the emergency exit locations prescribed in paragraph (b) of this section would be inconsistent with safe and rapid egress of passengers, variations of emergency exit locations shall be allowed if found appropriate by the Administrator. Passenger entrance, crew, and service doors shall be considered as emergency

exits if they meet the applicable requirements of this section.

(a) *Flight crew emergency exits.* Flight crew emergency exits shall be located in the flight crew area on both sides of the airplane or as a top hatch to provide for rapid evacuation. Such exits shall not be required on small airplanes where the Administrator finds that the proximity of passenger emergency exits to the flight crew area renders them convenient and readily accessible to the flight crew.

(b) *Passenger emergency exits; type and location.* The types of exits and their location shall be as follows:

(1) *Type I:* A rectangular opening of not less than 24 inches wide by 48 inches high, with corner radii not greater than 4 inches, located as far aft in the passenger area as practicable in the side of the fuselage at floor level.

(2) *Type II:* Same as Type I (subparagraph (1) of this paragraph) except that the opening is not less than 20 inches wide by 44 inches high.

(3) *Type III:* A rectangular opening of not less than 20 inches wide by 36 inches high, with corner radii not greater than 4 inches, located as far aft in the passenger area as practicable in the side of the fuselage.

(4) *Type IV:* A rectangular opening of not less than 19 inches wide by 28 inches high, with corner radii not greater than 4 inches, located over the wing in the side of the fuselage with a step-up inside the airplane of not more than 29 inches and a step-down outside the airplane of not more than 36 inches.

*Note:* Larger openings than those specified in paragraph (b) of this section will be acceptable, whether or not of rectangular shape, provided the specified rectangular openings can be inscribed therein, and further provided that the base of the opening affords a flat surface not less than the width specified.

(c) *Passenger emergency exits; number required.* Emergency exits of type and location prescribed in paragraph (b) of this section shall be accessible to the passengers and shall be provided on each side of the fuselage in accordance with the following:

Passenger seating capacity	Emergency exits required on each side of fuselage			
	Type I	Type II	Type III	Type IV
1 to 19 inclusive.....			1	
20 to 28 inclusive.....		1		1
29 to 38 inclusive.....	1			1
39 to 50 inclusive.....	1			2
51 to 60 inclusive.....	2			2

For airplanes with a passenger capacity of over 129 there shall be, in addition to

(d) *Ditching emergency exits.* Airplanes certificated in accordance with the ditching provisions of § 4b.261 shall be shown to have, on each side of the fuselage, not less than one emergency exit located above the water line for every 35 passengers: *Provided,* That for the purposes of this paragraph an easily accessible overhead hatch of not less than the clear dimensions of Type III emergency exits (see paragraph (b) (3) of this section) shall be considered equivalent to one emergency exit on each side.

(e) *Emergency exit arrangement.* (1) Emergency exits shall consist of movable doors or hatches in the external walls of the fuselage and shall provide an unobstructed opening to the outside.

(2) All emergency exits shall be operable from the inside and from the outside.

(3) The means of opening emergency exits shall be simple and obvious and shall not require exceptional effort of a person opening them.

(4) Means shall be provided for locking each emergency exit and for safeguarding against opening in flight either inadvertently by persons or as a result of mechanical failure.

(5) Means shall be provided for a direct visual inspection of the locking mechanism by crew members to ascertain whether all emergency exits are fully locked.

(6) Provision shall be made to minimize the possibility of jamming of emergency exits as a result of fuselage deformation in a minor crash landing.

(7) For all landplanes emergency exits other than Type IV (see paragraph (b) of this section) which are more than 6 feet from the ground with the airplane on the ground and the landing gear extended, means shall be provided to assist the occupants in descending to the ground.

(8) The proper functioning of emergency exit installations shall be demonstrated by test.

(f) *Emergency exit marking.* (1) All emergency exits, their means of access, and their means of opening shall be marked conspicuously. The identity and location of emergency exits shall be recognizable from a distance equal to the width of the cabin. The location of the emergency exit operating handle and the instructions for opening shall be marked on or adjacent to the emergency exit and shall be readable from a distance of 30 inches.

(2) A source or sources of light, with an energy supply independent of the main lighting system, shall be installed to illuminate all emergency exit markings. Such lights shall be designed to

means are required by paragraph (e) (7) of this section, there shall be sufficient additional space to allow a crew member to assist in the evacuation of passengers without reduction in the unobstructed width of the passageway to such exit.

(h) *Width of main aisle.* The main passenger aisle at any point between seats shall not be less than 15 inches wide up to a height above the floor of 25 inches and not less than 20 inches wide above that height.

**VENTILATION, HEATING, AND PRESSURIZATION**

§ 4b.370 *General.* The requirements of §§ 4b.371 through 4b.376 shall apply to the ventilation, heating, and pressurization of the aircraft.

§ 4b.371 *Ventilation.* (a) All crew compartments shall be ventilated by providing a sufficient amount of fresh air to enable the crew members to perform their duties without undue discomfort or fatigue.

*Note:* An outside air supply of approximately 10 cubic feet per minute is considered a minimum for each crew member.

(b) Ventilating air in crew and passenger compartments shall be free of harmful or hazardous concentrations of gases or vapors.

*Note:* Carbon monoxide concentrations in excess of one part in 20,000 parts of air are considered hazardous. Carbon dioxide in excess of 3 percent by volume (sea level equivalent) is considered hazardous in the case of crew members. Higher concentrations of carbon dioxide may not necessarily be hazardous in crew compartments if appropriate protective breathing equipment is available.

(c) Provision shall be made to insure the conditions prescribed in paragraph (b) of this section in the event of reasonably probable failures or malfunctioning of the ventilating, heating, pressurization, or other systems and equipment.

*Note:* Examples of acceptable provisions include secondary isolation, integral protective devices, and crew warning and shut-off for equipment the malfunctioning of which could introduce harmful or hazardous quantities of smoke or gases.

(d) Where partitions between compartments are equipped with louvres or other means allowing air to flow between such compartments, provision convenient to the crew shall be made for stopping the flow of air through the louvres or other means when such action is found necessary. (See also § 4b.367.)

(e) Means shall be provided to enable the crew to control the temperature and quantity of ventilating air supplied to the crew compartment independently of the temperature and quantity of ven-