(h) *Coolant temperature indicator.* Means shall be provided to indicate to the appropriate members of the flight crew, during flight, the coolant outlet temperature of each liquid-cooled engine.

Electrical Systems and Equipment

6.620 *Installation.*

(a) Electrical systems and equipment shall be free from hazards in themselves, in their method of operation, and in their effects on other parts of the rotorcraft. They shall be protected from fuel, oil, water, other detrimental substances, and from mechanical damage.

(b) The design of all components of the electrical system shall be appropriate for the intended use, and the components shall be capable of satisfactory operation over the entire range of environmental conditions encountered in the operation of the rotorcraft.

(c) Electrical sources of power shall have sufficient capacity during all normal flight operating conditions to supply the electrical load requirements without electrical or thermal distress. For emergency operating conditions the capacity of electrical power sources shall be sufficient for all electrical loads necessary to permit a safe landing.

6.621 *Batteries.* A battery or batteries shall be provided consistent with the needs of the electrical system in complying with the requirements of electrical power capacity. The installation shall provide adequate ventilation and drainage for the battery under all operating conditions, and means shall be provided to prevent corrosive battery substance from coming in contact with other parts of the rotorcraft during servicing or in flight.

6.622 *Generator system.*

(a) *Generator.* Sources of electrical power (including the battery) shall be designed to function coordinately, and shall also be capable of independent operation. The generator(s) shall be capable of delivering sufficient power to keep the batteries charged, and in addition shall provide for the normal electrical power requirements of the rotorcraft.

(b) *Generator controls.* Generator voltage control equipment shall be capable of regulating the generator output within rated limits.

(c) *Reverse current cut-off.* A generator reverse current cut-off shall disconnect the generator from the battery and from other generators when the generator is developing a voltage of such value that current sufficient to cause malfunctioning can flow into the generator.

6.623 *Master switch.* A master switch arrangement shall be provided which will disconnect all sources of electrical power from the main distribution system at a point adjacent to the power sources.

6.624 *Master switch installation.* The master switch or its controls shall be so installed that it is easily discernible and accessible to a member of the crew in flight.

6.625 *Protective devices.* Protective devices (fuses or circuit breakers) shall be installed in the circuits to all electrical equipment, except that such items need not be installed in the main circuits of starter motors or in other circuits where no hazard is presented by their omission. If fuses are used, one spare of each rating or 50 percent spare fuses of each rating, whichever is the greater, shall be provided.

6.625–1 *Automatic reset circuit breakers (CAA policies which apply to sec. 6.625).* Automatic reset circuit breakers (which automatically reset themselves periodically) should not be applied as circuit protective devices.[1] They may be used as integral protectors for electrical equipment (for example thermal cutouts) provided that circuit protection is also installed to protect the cable to the equipment.

(19 F. R. 8140, Dec. 10, 1954, effective Dec. 15, 1954.)

6.625–2 *Circuit breakers (CAA policies which apply to sec. 6.625).* All resettable type

[1] Circuit protective devices are normally installed to limit the hazardous consequences of overloaded or faulted circuits. These devices are resettable (circuit breakers) or replaceable (fuses) to permit the crew to restore service when nuisance trips occur or when the abnormal circuit condition can be corrected in flight. If the abnormal circuit condition can *not* be corrected in flight, the decision to restore power to the circuit involves a careful analysis of the flight situation. It is necessary to weight the essentiality of the circuit for continued safe flight against the hazards of resetting on a possibly faulted circuit. Such evaluation is properly an aircraft crew function which can not be performed by automatic reset circuit breakers. To assure crew supervision over the reset operation, circuit protective devices should be of such design that a manual operation is required to restore service after tripping.

circuit protective devices should be so designed that, when an overload or circuit fault exists, they will open the circuit irrespective of the position of the operating control.[2]

(21 F. R. 2585, Apr. 20, 1956, effective May 15, 1956.)

6.626 ***Protective devices installation.*** **Protective devices in circuits essential to safety in flight shall be conveniently located and properly identified to facilitate replacement of fuses or resetting of circuit breakers in flight.**

6.627 ***Electric cables.*** **The electric cables used shall be in accordance with approved standards for aircraft electric cable of a slow-burning type. They shall have current-carrying capacity sufficient to deliver the necessary power to the items of equipment to which they are connected.**

6.628 ***Switches.*** **Switches shall be capable of carrying their rated current. They shall be accessible to the crew and shall be labeled as to operation and the circuit controlled.**

Lights

6.630 ***Instrument lights.***

(a) Instrument lights shall provide sufficient illumination to make all instruments, switches, etc., easily readable.

(b) Instrument lights shall be so installed that their direct rays are shielded from the pilot's eyes and so that no objectionable reflections are visible to him.

6.631 ***Landing lights.***

(a) When landing or hovering lights are required, they shall be of an approved type.

(b) Landing lights shall be installed so that there is no objectionable glare visible to the pilot and so that the pilot is not adversely affected by halation.

(c) Landing lights shall be installed in a location where they provide the necessary illumination for night operation including hovering and landing.

(d) A switch for each light shall be provided, except that where multiple lights are installed at one location a single switch for the multiple lights shall be acceptable.

[2] Circuit protective devices which conform to the above description are known commercially as "trip-free," that is, the tripping mechanism cannot be overridden by the operating control. Such circuit protective devices can be reset on an overload or circuit fault, but will trip subsequently in accordance with their current-time characteristics.

6.632 ***Position light system installation.***

[(a) *General.* The provisions of sections 6.632 through 6.635 shall be applicable to the position light system as a whole. The position light system shall include the items specified in paragraphs (b) through (e) of this section.]

(b) *Forward position lights.* Forward position lights shall consist of a red and a green light spaced laterally as far apart as practicable and installed forward on the rotorcraft in such a location that, with the rotorcraft in normal flying position, the red light is displayed on the left side and the green light is displayed on the right side. The individual lights shall be of an approved type.

(c) *Rear position light.* The rear position light shall be a white light mounted as far aft as practicable. The light shall be of an approved type.

(d) *Circuit.* The two forward position lights and the rear position light shall constitute a single circuit.

(e) *Light covers and color filters.* Light covers or color filters used shall be of noncombustible material and shall be constructed so that they will not change color or shape or suffer any appreciable loss of light transmission during normal use.

6.633 ***Position light system dihedral angles.*** **The forward and rear position lights as installed on the rotorcraft shall show unbroken light within dihedral angles specified in paragraphs (a) through (c) of this section.**

(a) Dihedral angle *L* (left) shall be considered formed by two intersecting vertical planes, one parallel to the longitudinal axis of the rotorcraft and the other at 110° to the left of the first, when looking forward along the longitudinal axis.

(b) Dihedral angle *R* (right) shall be considered formed by two intersecting vertical planes, one parallel to the longitudinal axis of the rotorcraft and the other at 110° to the right of the first, when looking forward along the longitudinal axis.

(c) Dihedral angle *A* (aft) shall be considered formed by two intersecting vertical planes making angles of 70° to the right and 70° to the left, respectively, looking aft along the longi-

tudinal axis, to a vertical plane passing through the longitudinal axis.

6.634 *Position light distribution and intensities.*

(a) *General.* The intensities prescribed in this section are those to be provided by new equipment with all light covers and color filters in place. Intensities shall be determined with the light source operating at a steady value equal to the average luminous output of the light source at the normal operating voltage of the rotorcraft. The light distribution and intensities of position lights shall comply with the provisions of paragraph (b) of this section.

(b) *Forward and rear position lights.* The light distribution and intensities of forward and rear position lights shall be expressed in terms of minimum intensities in the horizontal plane, minimum intensities in any vertical plane, and maximum intensities in overlapping beams, within dihedral angles L, R, and A, and shall comply with the provisions of subparagraphs (1) through (3) of this paragraph.

(1) *Intensities in horizontal plane.* The intensities in the horizontal plane shall not be less than the values given in Figure 6–1. (The horizontal plane is the plane containing the longitudinal axis of the rotorcraft and is perpendicular to the plane of symmetry of the rotorcraft.)

(2) *Intensities above and below horizontal.* The intensities in any vertical plane shall not be less than the appropriate value given in Figure 6–2, where I is the minimum intensity prescribed in Figure 6–1 for the corresponding angles in the horizontal plane. (Vertical planes are planes perpendicular to the horizontal plane.)

(3) *Overlaps between adjacent signals.* The intensities in overlaps between adjacent signals shall not exceed the values given in Figure 6–3, except that higher intensities in the overlaps shall be acceptable with the use of main beam intensities substantially greater than the minima specified in Figures 6–1 and 6–2 if the overlap intensities in relation to the main beam intensities are such as not to affect adversely signal clarity.

Dihedral angle	Angle from right or left of longitudinal axis, measured from dead ahead	Intensity (candles)
L and *R* (forward red and green)	0° to 10°	40
	10° to 20°	30
	20° to 110°	5
A (rear white)	110° to 180°	20

Figure 6–1.—Minimum Intensities in the Horizontal Plane of Forward and Rear Position Lights

Angle above or below horizontal	Intensity
0°	1.00 I.
0° to 5°	.90 I.
5° to 10°	.80 I.
10° to 15°	.70 I.
15° to 20°	.50 I.
20° to 30°	.30 I.
30° to 40°	.10 I.
40° to 90°	At least 2 candles.

Figure 6–2.—Minimum Intensities in Any Vertical Plane of Forward and Rear Position Lights

Overlaps	Maximum intensity	
	Area A (candles)	Area B (candles)
Green in dihedral angle *L*	10	1
Red in dihedral angle *R*	10	1
Green in dihedral angle *A*	5	1
Red in dihedral angle *A*	5	1
Rear white in dihedral angle *L*	5	1
Rear white in dihedral angle *R*	5	1

Figure 6–3.—Maximum Intensities in Overlapping Beams of Forward and Rear Position Lights

NOTE: Area A includes all directions in the adjacent dihedral angle which pass through the light source and which intersect the common boundary plane at more than 10 degrees but less than 20 degrees. Area B includes all directions in the adjacent dihedral angle which pass through the light source and which intersect the common boundary plane at more than 20 degrees.

6.635 *Color specifications.* The colors of the position lights shall have the International Commission on Illumination chromaticity coordinates as set forth in paragraphs (a) through (c) of this section.

(a) *Aviation red.*

y is not greater than 0.335,

z is not greater than 0.002;

(b) *Aviation green.*

x is not greater than $0.440-0.320y$,

x is not greater than $y-0.170$,

y is not less than $0.390-0.170x$;

(c) *Aviation white.*

x is not less than 0.350.

x is not greater than 0.540.

$y-y_0$ is not numerically greater than 0.01, y_0 being the y coordinate of the Planckian radiator for which $x_0=x$.

6.636 *Riding light.*

(a) When a riding (anchor) light is required for a rotorcraft operated from water, it shall be capable of showing a white light for at least 2 miles at night under clear atmospheric conditions.

(b) Riding lights shall be installed so that they will show a maximum practicable unbroken light when the rotorcraft is moored or drifting on the water. Externally hung lights shall be permitted.

[6.637 *Anti-collision light system.* An airplane to be eligible for night operation shall have installed an anti-collision light system. Such system shall consist of one or more approved anti-collision lights so located that the emitted light will not be detrimental to the crew's vision and will not detract from the conspicuity of the position lights. The system shall comply with the provisions of paragraphs (a) through (d) of this section.

[(a) *Field of coverage.* The system shall consist of such lights as will afford coverage of all vital areas around the rotorcraft with due consideration to the physical configuration and flight characteristics of the rotorcraft. In any case, the field of coverage shall extend in all directions within 30° above and 30° below the horizontal plane of the rotorcraft, except that a solid angle or angles of obstructed visibility totaling not more than .03 steradians shall be permissible.

[(b) *Flashing characteristics.* The arrangement of the system, i. e., number of light sources, beam width, speed of rotation, etc., shall be such as to give an effective flash frequency of not less than 40 and not more than 100 cycles per minute. The effective flash frequency shall be the frequency at which the rotorcraft's complete anti-collision light system is observed from a distance, and shall apply to all sectors of light including the overlaps which might exist when the system consists of more than one light source. In overlaps, flash frequencies higher than 100 cycles per minute shall be permissible, except that they shall not be higher than 180 cycles per minute.

[(c) *Color.* The color of the anti-collision lights shall be aviation red in accordance with section 6.635 (a).

[(d) *Light intensity.* The minimum light intensities in all vertical planes, measured with the red filter and expressed in terms of "effective" intensities, shall be in accordance with Figure 6-4. The following relation shall be assumed:

$$I_e=\frac{\int_{t_1}^{t_2} I(t)\,dt}{0.2+(t_2-t_1)};$$

where:

I_e = effective intensity (candles),

$I(t)$ = instantaneous intensity as a function of time,

t_2-t_1 = flash time interval (seconds)

[NOTE: Normally, the maximum value of effective intensity is obtained when t_2 and t_1 are so chosen that the effective intensity is equal to the instantaneous intensity at t_2 and t_1.

Angle above or below horizontal plane	Effective intensity (candles)
0° to 5°	100
5° to 10°	60
10° to 20°	20
20° to 30°	10

[Figure 6-4—Minimum Effective Intensities for Anti-collision Lights]

(Rev. 6/15/57)

Safety Equipment

6.640 *General.* Required safety equipment which the crew is expected to operate at a time of emergency, such as flares and automatic life-raft releases, shall be readily accessible. (See also sec. 6.738 (e).)

6.641 *Flares.* When parachute flares are installed, they shall be of an approved type, and their installation shall be in accordance with section 6.642.

6.642 *Flare installation.*

(a) Parachute flares shall be releasable from the pilot compartment and installed to minimize the danger of accidental discharge.

(b) It shall be demonstrated in flight that the flare installation is such that ejection can be accomplished without hazard to the rotorcraft and its occupants.

(c) If recoil loads are involved in the ejection of the flares, the structure of the rotocraft shall be designed to withstand such loads.

6.643 *Safety belts.* Rotorcraft manufactured on or after the effective date of this part shall be equipped with safety belts of an approved type. (See sec. 6.18.) In no case shall the rated strength of the safety belt be less than that corresponding with the ultimate load factors specified, taking due account of the dimensional characteristics of the safety belt installation for the specific seat or berth arrangement. Safety belts shall be attached so that no part of the anchorage will fail at a load lower than that corresponding with the ultimate load factors specified. (See sec. 6.260.)

6.644 *Emergency flotation and signaling equipment.* When emergency flotation and signaling equipment is required by the operating rules of the Civil Air Regulations, such equipment shall comply with the provisions of paragraphs (a) through (c) of this section.

(a) Rafts and life preservers shall be of an approved type and shall be so installed as to be readily available to the crew and passengers.

(b) Rafts released automatically or released by the pilot shall be attached to the rotorcraft by means of lines to keep them alongside the rotorcraft. The strength of the lines shall be such that they will break before submerging the empty raft.

[Appendix B

[Special Civil Air Regulations Which Affect Part 6

[SPECIAL CIVIL AIR REGULATION NO. SR-392B

[Effective: February 25, 1957
[*Adopted:* February 25, 1957

[Facilitation of Experiments with Exterior Lighting Systems

[Special Civil Air Regulation No. SR-392A adopted June 29, 1955, permits air carriers, subject to the approval of the Administrator, to install and use experimentally, on a limited number of their airplanes, exterior lighting systems which do not conform to the specifications contained in Part 4b of the Civil Air Reguations. The purpose of SR-392A was to permit experimentation on large airplanes while retaining their standard airworthiness certification. Prior to that time such experimentation was conducted either on Government-owned aircraft or on private aircraft limited in operations to the conditions of an experimental certificate.

[SR-392A does not extent the permission for experimentation with exterior lights to non-air-carrier aircraft because at the time of its adoption only air carrier operators indicated interest in this activity. Recently, however, new experimental developments in anti-collision light systems have aroused the interest of private and corporate operators to the extent that some of the operators apparently wish to install the new systems on their aircraft for purposes of experimentation. The Board sees no valid reason why operators other than air carriers should not be permitted to participate, if they wish, in experiments intended to improve the effectiveness of aircraft exterior lighting, provided that the number of such aircraft is reasonably limited.

[Since future experimentation is to be conducted more widely and by private individuals, the Board believes that conditions should be imposed which will assure that the experimental exterior lights are in fact installed for purposes of bona fide experimentation and that the results of such experimentation become available to the Government and to all other interested persons.

[Interested persons have been afforded an opportunity to participate in the making of this regulation (21 F. R. 3388), and due consideration has been given to all relevant matter presented. Since this regulation imposes no additional burden on any person, it may be made effective on less than 30 days' notice.

[In consideration of the foregoing, the Civil Aeronautics Board hereby makes and promulgates the following Special Civil Air Regulation, effective February 25, 1957.

[Contrary provisions of the Civil Air Regulations notwithstanding, experimental exterior lighting equipment which does not comply with the relevant specifications contained in the Civil Air Regulations may, subject to the approval of the Administrator, be installed and used on aircraft for the purpose of experimentation intended to improve exterior lighting for a period not to exceed six months: *Provided,* That

[(1) The Administrator may grant approval for additional periods if he finds that the experiments can be reasonably expected to contribute to improvements in exterior lighting;

[(2) Not more than 15 aircraft possessing a U. S. certificate of airworthiness may have installed at any one time experimental exterior lighting equipment of one basic type;

[(3) The Administrator shall prescribe such conditions and limitations as may be necessary to insure safety and avoid confusion in air navigation;

[(4) The person engaged in the operation of the aircraft shall disclose publicly the deviations of the exterior lighting from the relevant specifications contained in the Civil Air Regulations at times and in a manner prescribed by the Administrator; and

[(5) Upon application for approval to conduct experimentation with exterior lighting, the applicant shall advise the Administrator of the specific purpose of the experiments to be conducted; and at the conclusion of the approved period of experimentation, he shall advise the Administrator of the detailed results thereof.

[This regulation supersedes Special Civil Air Regulation No. SR–392A and shall terminate February 25, 1962, unless sooner superseded or rescinded.]

(Rev. 6/15/57)

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