

aircraft in the event of their malfunction or failure.

(c) Where an installation, the functioning of which is necessary in showing compliance with the applicable requirements, requires a power supply, that installation must be considered an essential load on the power supply, and the power sources and the distribution system must be capable of supplying the following power loads in probable operation combinations and for probable durations:

(1) All essential loads after failure of any prime mover, power converter, or energy storage device.

(2) All essential loads after failure of any one engine on two-engine airplanes.

(3) In determining the probable operating combinations and durations of essential loads for the power failure conditions described in paragraphs (1) and (2) of this paragraph, it is permissible to assume that the power loads are reduced in accordance with a monitoring procedure which is consistent with safety in the types of operations authorized.

60. *Ventilation.* The ventilation system of the airplane must meet FAR 23.831, and in addition, for pressurized aircraft, the ventilating air in flight crew and passenger compartments must be free of harmful or hazardous concentrations of gases and vapors in normal operation and in the event of reasonably probable failures or malfunctioning of the ventilating, heating, pressurization, or other systems, and equipment. If accumulation of hazardous quantities of smoke in the cockpit area is reasonably probable, smoke evacuation must be readily accomplished.

*Electrical Systems and Equipment*

61. *General.* The electrical systems and equipment of the airplane must meet FAR 23.1351, and the following:

(a) *Electrical system capacity.* The required generating capacity, and number and kinds of power sources must—

(1) Be determined by an electrical load analysis; and

(2) Meet FAR 23.1301.

(b) *Generating system.* The generating system includes electrical power sources, main power busses, transmission cables, and asso-

ciated control, regulation and protective devices. It must be designed so that—

(1) The system voltage and frequency (as applicable) at the terminals of all essential load equipment can be maintained within the limits for which the equipment is designed, during any probable operating conditions;

(2) System transients due to switching, fault clearing, or other causes do not make essential loads inoperative, and do not cause a smoke or fire hazard;

(3) There are means, accessible in flight to appropriate crewmembers, for the individual and collective disconnection of the electrical power sources from the system; and

(4) There are means to indicate to appropriate crewmembers the generating system quantities essential for the safe operation of the system, including the voltage and current supplied by each generator.

62. *Electrical equipment and installation.* Electrical equipment, controls, and wiring must be installed so that operation of any one unit or system of units will not adversely affect the simultaneous operation of any other electrical unit or system essential to the safe operation.

63. *Distribution system.* (a) For the purpose of complying with this section, the distribution system includes the distribution busses, their associated feeders, and each control and protective device.

(b) Each system must be designed so that essential load circuits can be supplied in the event of reasonably probable faults or open circuits, including faults in heavy current carrying cables.

(c) If two independent sources of electrical power for particular equipment or systems are required under this appendix, their electrical energy supply must be ensured by means such as duplicate electrical equipment, throwover switching, or multichannel or loop circuits separately routed.

64. *Circuit protective devices.* The circuit protective devices for the electrical circuits of the airplane must meet FAR 23.1357, and in addition circuits for loads which are essential to safe operation must have individual and exclusive circuit protection.

APPENDIX B TO PART 135—AIRPLANE FLIGHT RECORDER SPECIFICATIONS

Parameters	Range	Installed system <sup>1</sup> minimum accuracy (to recovered data)	Sampling interval (per second)	Resolution <sup>4</sup> read out
Relative time (from recorded on prior to takeoff).	25 hr minimum .....	±0.125% per hour .....	1 .....	1 sec.
Indicated airspeed .....	V <sub>so</sub> to V <sub>D</sub> (KIAS) .....	±5% or ±10 kts., whichever is greater. Resolution 2 kts. below 175 KIAS.	1 .....	1% <sup>3</sup> .
Altitude .....	- 1,000 ft. to max cert. alt. of A/C.	±100 to ±700 ft. (see Table 1, TSO C51-a).	1 .....	25 to 150
Magnetic heading .....	360° .....	±5° .....	1 .....	1°

Parameters	Range	Installed system <sup>1</sup> minimum accuracy (to recovered data)	Sampling interval (per second)	Resolution <sup>4</sup> read out
Vertical acceleration .....	−3g to +6g .....	±0.2g in addition to ±0.3g maximum datum.	4 (or 1 per second where peaks, ref. to 1g are recorded).	0.03g.
Longitudinal acceleration .....	±1.0g .....	±1.5% max. range excluding datum error of ±5%.	2 .....	0.01g.
Pitch attitude .....	100% of usable .....	±2° .....	1 .....	0.8°
Roll attitude .....	±60° or 100% of usable range, whichever is greater.	±2° .....	1 .....	0.8°
Stabilizer trim position .....	Full range .....	±3% unless higher uniquely required.	1 .....	1% <sup>3</sup> .
Or Pitch control position .....	Full range .....	±3% unless higher uniquely required.	1 .....	1% <sup>3</sup> .
<i>Engine Power, Each Engine</i> Fan or N <sub>1</sub> speed or EPR or cockpit indications used for aircraft certification. Or Prop. speed and torque (sample once/sec as close together as practicable).	Maximum range .....	±5% .....	1 .....	1% <sup>3</sup> .
Altitude rate <sup>2</sup> (need depends on altitude resolution).	±8,000 fpm .....	±10%. Resolution 250 fpm below 12,000 ft. indicated.	1 .....	250 fpm Below 12,000
Angle of attack <sup>2</sup> (need depends on altitude resolution).	−20° to 40° or of usable range.	±2° .....	1 .....	0.8° <sup>3</sup>
Radio transmitter keying (discrete).	On/off .....	.....	1.	
TE flaps (discrete or analog) ..	Each discrete position (U, D, T/O, AAP). Or. Analog 0–100% range ....	..... ±3° .....	1. 1 .....	1% <sup>3</sup>
LE flaps (discrete or analog) ..	Each discrete position (U, D, T/O, AAP). Or. Analog 0–100% range ....	..... ±3° .....	1. 1 .....	1% <sup>3</sup> .
Thrust reverser, each engine (Discrete).	Stowed or full reverse ....	.....	1.	
Spoiler/speedbrake (discrete)	Stowed or out .....	.....	1.	
Autopilot engaged (discrete) ..	Engaged or disengaged .....	.....	1.	

<sup>1</sup>When data sources are aircraft instruments (except altimeters) of acceptable quality to fly the aircraft the recording system excluding these sensors (but including all other characteristics of the recording system) shall contribute no more than half of the values in this column.

<sup>2</sup>If data from the altitude encoding altimeter (100 ft. resolution) is used, then either one of these parameters should also be recorded. If however, altitude is recorded at a minimum resolution of 25 feet, then these two parameters can be omitted.

<sup>3</sup>Per cent of full range.

<sup>4</sup>This column applies to aircraft manufacturing after October 11, 1991.

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APPENDIX C TO PART 135—HELICOPTER FLIGHT RECORDER SPECIFICATIONS

Parameters	Range	Installed system <sup>1</sup> minimum accuracy (to recovered data)	Sampling interval (per second)	Resolution <sup>3</sup> read out
Relative time (from recorded on prior to takeoff).	25 hr minimum .....	±0.125% per hour .....	1 .....	1 sec.
Indicated airspeed .....	V <sub>m</sub> in to V <sub>D</sub> (KIAS) (minimum airspeed signal attainable with installed pilot-static system).	±5% or ±10 kts., whichever is greater.	1 .....	1 kt.
Altitude .....	−1,000 ft. to 20,000 ft. pressure altitude.	±100 to ±700 ft. (see Table 1, TSO C51–a).	1 .....	25 to 150 ft.
Magnetic heading .....	360° .....	±5° .....	1 .....	1°.