Code of Federal Regulations

This Section of CFR is No Longer Current.

Sec. 33.77

Part 33 AIRWORTHINESS STANDARDS: AIRCRAFT ENGINES	
Subpart E--Design and Construction; Turbine Aircraft Engines	

Sec. 33.77

Foreign object ingestion.

(a) Ingestion of a 4-pound bird, under the conditions prescribed in paragraph (e) of this section, may not cause the engine to--
(1) Catch fire;
(2) Burst (release hazardous fragments through the engine case);
(3) Generate loads greater than those ultimate loads specified in Sec. 33.23(a); or
(4) Lose the capability of being shut down.
(b) Ingestion of 3-ounce birds or 1 1/2-pound birds, under the conditions prescribed in paragraph (e) of this section, may not--
(1) Cause more than a sustained 25 percent power or thrust loss;
(2) Require the engine to be shut down within 5 minutes from the time of ingestion; or
(3) Result in a potentially hazardous condition.
[(c) Ingestion of ice under the conditions prescribed in paragraph (e) of this section, may not cause a sustained power or thrust loss or require the engine to be shut down.**]**
(d) For an engine that incorporates a protection device, compliance with this section need not be demonstrated with respect to foreign objects to be ingested under the conditions prescribed in paragraph (e) of this section if it is shown that--
(1) Such foreign objects are of a size that will not pass through the protective device;
(2) The protective device will withstand the impact of the foreign objects and
(3) The foreign object, or objects, stopped by the protective device will not obstruct the flow of induction air into the engine with a resultant sustained reduction in power or thrust greater than those values required by paragraphs (b) and (c) of this section.
[(e) Compliance with paragraphs (a), (b), and (c) of this section must be shown by engine test under the following ingestion conditions:

Foreign object	Test quantity	Speed of foreign object	Engine operation	Ingestion
BIRDS:				
3-ounce size	One for each 50 square inches of inlet area, or	Liftoff speed of typical aircraft.	Takeoff	In rapid sequence to simulate a flock

	fraction thereof, up to a maximum of 16 birds. Three-ounce bird will pass the inlet guide vanes into the rotor blades.			encounter and aimed at selected critical areas.
1-1/2-pound size	One for the first 300 square inches of inlet area, if it can enter the inlet, plus one for each additional 600 square inches of inlet area, or fraction, thereof up to a maximum of 8 birds.	Initial climb speed of typical aircraft.	Takeoff	In rapid sequence to simulate a flock encounter and aimed at selected critical areas.
4-pound size	One, if it can enter the inlet	Maximum climb speed of typical aircraft, if the engine has inlet guide vanes.	Maximum cruise	Aimed at critical area.
		Liftoff speed of typical aircraft, if the engine does not have inlet guide vanes.	Takeoff	Aimed at critical area.
ICE:	Maximum accumulation on a typical inlet cowl and engine face resulting from a 2-minute delay in actuating anti-icing system, or a slab of ice which is	Sucked in	Maximum cruise	To simulate a continuous maximum icing encounter at 25°F.

	comparable in weight or thickness for that size engine.			

Note: The term "inlet area" as used in this section means the engine inlet projected area at the front face of the engine. It includes the projected area of any spinner or bullet nose that is provided.**]**

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Comments

Document History

Notice of Proposed Rulemaking Actions:

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