U.S. Department
of Transportation
**Federal Aviation
Administration**

Memorandum

Subject: **INFORMATION**: Certification of Small, Single-Engine Piston or Turbopropeller Airplanes Used for Special Purpose Agricultural Operations

Date: DEC 1 1997

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This memo is intended as policy guidance for the type certification of new small piston or turbopropeller single-engine airplanes used for special purpose agricultural operations. As a result of meetings between Agricultural Airplane Manufacturers and the FAA's Agricultural Airplane Certification Team, it has been determined that the intent of a number of regulations used in the type certification basis of special purpose, restricted category, agricultural airplanes needs to be clarified. The clarifications are based on Amendment Level 23-52. For special purpose, restricted category, single-engine agricultural airplanes using the normal category requirements of Part 23 as a certification basis, the following clarifications are made.

Section 23.49

Stalling speed

Stall speeds per 14 CFR Part 23, § 23.49 must be obtained at the maximum certificated gross weight. These aircraft may be found exempt from the 61-knot stall speed at maximum gross weight providing that acceptable crashworthiness designs are

incorporated into the aircraft. However, V_{SO} with the hopper empty must not be greater than 61 knots. Compliance with § 23.49(b) may be demonstrated with the aircraft configured to be at its maximum operational weight minus the weight of a full hopper load. This maximum operational weight will include, as a minimum, complete crew (pilot and crew member, if crew seat is available), full fuel, the heaviest combination of dispersal equipment, and all auxiliary tanks (hopper rinse, smoke tank, etc.) full or at the maximum operational level. Although V_{SO} with the hopper empty must not be more than 61 knots, the bottom of the green and white arcs on the airspeed indicator must be marked with the V_{SO} and V_{S1} established at the maximum certificated gross weight.

Section 23.53

Takeoff speeds

The requirements of § 23.53(b)(2) must be demonstrated with the aircraft in the highest drag dispersal equipment configuration and at maximum certificated gross weight. This would be considered an emergency maneuver where the hopper load could not be dumped or it would be preferred not to be dumped.

Section 23.65

Climb: All engines operating

As an alternative to the normal category requirements of Part 23: Restricted category agricultural aircraft must meet a minimum climb gradient of 2.5 percent or 200 feet per minute, whichever is greater, at all altitudes and temperatures for which the aircraft is approved to operate, regardless of the type of engine (reciprocating or turbine). The flap position and climb speed must be the same as that used for § 23.53(b)(2) at 50 feet. This must be accomplished at each dispersal equipment configuration (spray and booms, spreader, etc.). The AFM information showing the weight at which the required climb gradient can be met must be provided. – See last page

Section 23.143

FLIGHT CHARACTERISTICS
General

In addition, the aircraft must be safely controllable and maneuverable during an emergency hopper dump with and without engine power. Consideration of partial hopper loads should be investigated during all operations.

Section 23.155

Elevator control force in maneuvers

It is desired that control forces in maneuvers be lighter than those required for other categories of Part 23. Considering the frequency of maneuvers experienced during a typical mission for this type of aircraft, high levels of stability will result in control forces that lead to pilot fatigue. However, some level of control force must be provided to deter the pilot from inadvertently overstressing the aircraft. Therefore, the elevator control force needed to achieve the positive limit maneuvering load factor may not be less than 15 pounds and need not be greater than 35 pounds. Advisory Circular 23-8A contains an appropriate method of compliance.

Section 23.171

STABILITY
General

The aircraft must comply with stability requirements in all dispersal configurations offered for certification.

Section 23.175

Demonstration of static longitudinal stability

Stick force versus airspeed curve slopes are expected to be low, but must be positive. With dispersal equipment installed at both forward and aft c.g. limits, the aircraft must have positive longitudinal stability. Providing the aircraft is stable in climb, it is not necessary to investigate the conditions of § 23.175(b), Cruise, or § 23.175(c), Landing.

Section 23.177

Static directional and lateral stability

Compliance must be shown for all dispersal equipment configurations at both forward and aft c.g. limits.

Section 23.251

Vibration and buffeting

The aircraft must be demonstrated to be free of vibration and buffeting in the clean (no dispersal equipment installed) configuration at all speeds up to V_D. In addition, the aircraft must be demonstrated to be free of vibration and buffeting in all dispersal

equipment configurations to V_{NE} or to 10 percent greater than maximum dispersal equipment limiting speed.

Section 23.562

Emergency landing dynamic conditions

The airplane must be evaluated with at least the following considerations:

1. The placement of the chemical hopper forward of the cockpit so that there is no large item of mass that threatens to collapse the cockpit should a crash occur.

2. The elimination of protruding knobs, handles, or other rigid structures in the cockpit with which the pilot or crew member may come into contact, in the event of a crash. Approved Department of Transportation or Mil-Spec protective headgear is mandatory.

3. Installation of a military type lap belt and shoulder harness having a 5,000 pound rating or greater or approved equivalent.

4. Special purpose crew members who assist in the aerial application operation, i.e. flaggers, loaders, can be carried in ferry flights provided that the crew member has his/her own seat, a lap belt and shoulder harness comparable in strength to that of the pilots, the crew seat is not in the cockpit, and the crew seat is located behind the pilot seat. Special purpose crew members that are carried for any other purpose will be afforded the same protection as that of the pilot.

Section 23.901(d)(2)

INSTALLATION
(Turbine engine operation in rain)

Most turboshaft engines have shown compliance with this requirement under § 33.77. If a particular engine has not been certificated to this standard, the Engine and Propeller Directorate will assist the Aircraft Certification Office (ACO) in reviewing the engine inlet and test requirements. Typically, compliance for this requirement can be evaluated in ground tests by temporarily installing a water spray system in the engine inlet for flight idle and maximum power tests. During a ground run at the two test conditions, regulate the water mass flow rate to 4 percent of the engine air mass flow rate

Section 23.954

Fuel system lightning protection

A limitation in the Airplane Flight Manual will be sufficient to address this regulation, for example, "Operation of the airplane in and around thunderstorms is prohibited."

Section 23.1043

Cooling tests

Conduct engine cooling test per AC 23-8A, except as follows: After the temperature has stabilized for the pre-takeoff holding condition on the taxiway, feather the propeller and record the data until the temperatures stabilize. Note: This simulates normal agricultural operational engine running loading conditions. This criteria can be disregarded if the propeller is not feathered during normal agricultural operations on the ground.

Section 23.1093

Induction system icing protection

A limitation in the Airplane Flight Manual will be sufficient to address this regulation, for example, "Operation of the airplane in visible moisture below 40 °F is prohibited."

Section 23.1141(e)

Powerplant controls: general

For turbine engine powered airplanes, no single failure or malfunction, or probable combination thereof, in any powerplant control system, may cause the failure of any powerplant function necessary for safety. For agricultural airplanes, the deletion of "or probable combination thereof," from the above paragraph is acceptable.

Section 23.1163(a)(1)

Powerplant accessories

Each engine mount accessory must be acceptable for mounting on the engine involved and use the proper provision on the engines for mounting.

Section 23.1583

Operating limitations

The airplane is not to be operated above its maximum certificated gross weight.

Section 23.1587

Performance information

If the alternative described in § 23.65 is used, then takeoff weight versus altitude and temperature is required. Takeoff performance distances per § 23.51 must be provided showing takeoff ground roll distance, plus total distance to a 50-foot obstacle, versus altitude and temperature, at the maximum takeoff weight. The altitude and temperature limits are to be within the operational limitations of the aircraft as selected by the applicant. As a minimum, takeoff distance must be presented using the highest drag dispersal equipment.

Any questions concerning the clarifications made should be referred to the Small Airplane Directorate , Regulations and Policy Section, ACE-111.

for John Colomy

cc: AIR-100 (mailed on 12/4/97 by tdj)