

# Federal Aviation Agency



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Change 1

SUBJECT : APPROVAL BASIS FOR ~~ROTORCRAFT~~ **AUTOMATIC STABILIZATION EQUIPMENT (ASE)**  
INSTALLATIONS IN ~~ROTORCRAFT~~

1. PURPOSE. This circular sets forth acceptable means, ~~not the sole means,~~ by which compliance may be shown with the flight requirements for ASE installations in accordance with the reference ~~regulations in~~ 2 below.
2. REFERENCE REGULATIONS.
  - a. ~~CARs 6.10 and 7.10~~ **Eligibility for type certificates.**
  - b. ~~CARs 6.601 and 7.601, Functional and installational requirements.~~
  - c. ~~CARs 6.606(b) and 7.606(b), Hazards.~~
3. DISCUSSION.
  - a. Parts 6 ~~and 7~~ rotorcraft ~~airworthiness~~ **regulations do** not speak specifically to flight requirements for ~~the~~ installation of ASE equipment. The referenced ~~regulations~~ **do**, however, set forth objective standards for the installation of optional equipment such as the automatic stabilization equipment, etc. This ~~type~~ of equipment has been installed and approved on several helicopters in the past, and the criteria set forth in this document are essentially the same as those utilized in the determination of compliance for these past ~~approvals.~~
  - b. Basically, the means of compliance contained ~~herein are similar~~ to ~~that~~ required for ~~autopilot installations,~~ **and provide** for the equipment to:
    - (1) **Function** properly (reference ~~6.601~~ and ~~7.601~~).
    - (2) Not create any unsafe conditions ~~in normal~~ operation (reference ~~6.10~~ and ~~7.10~~).
    - (3) Not create any hazard ~~in the event of malfunction or~~ **failure** (reference ~~6.606(b)~~ and ~~7.606(b)~~).

40 ACCEPTABLE MEANS OF COMPLIANCE.

- a) An ~~analysis~~ of the automatic stabilization equipment system ~~com-~~  
~~ponents and~~ associated systems should be made to determine to  
what extent a single failure will ~~produce signals in the system~~  
which will adversely affect the flight control system.  
signals should be ~~introduced~~ during flight test as required in  
paragraph b(1).
- b) To preclude hazardous conditions which may result from any failure  
or ~~malfunctioning~~ of the automatic ~~stabilization~~ equipment, or its  
inadvertent use by the human pilot, the following conditions should  
be investigated by flight tests:
- (1) A signal about any axis equivalent to the ~~cumulative~~ effect of  
any single failure (or if multiple axis failure can result  
from the malfunction of ~~any single~~ component, ~~combined signals~~  
from all affected axes) should be induced into the automatic  
stabilization ~~equipment~~ during all maneuvers and flight regimes  
appropriate to its use.
  - (2) If the equipment is to be approved without flight restrictions  
(operating at all ~~times~~), such ~~malfunctions~~ should be demon-  
strated to be satisfactory during takeoff, ~~climb~~, cruising,  
landing, maneuvering, and hovering.
  - (3) ~~If~~ a flight restriction is provided, it should be determined  
as appropriate for the type and its operation. Appropriate  
operating ~~limitations~~ should be specified and significant  
information regarding the restriction should be made avail-  
able to the pilot in the ~~operating~~ procedures section of the  
rotorcraft ~~flight~~ manual. A means shall be provided to engage  
and disengage the equipment and a ~~visual means~~ should be pro-  
vided to indicate when the equipment ~~is operating~~.
  - (4) When corrective action is taken with appropriate time delay  
after the rotorcraft response to the malfunction, neither the  
simulated failure nor the subsequent corrective ~~action~~ should  
create either hazardous loads or speeds, or dangerous attitude  
or flightpath ~~deviations~~.
  - (5) ~~Recovery~~ should be demonstrated with ~~the use~~ of normal controls  
~~or~~ by manual use of an emergency ~~disconnect~~, if such a device  
is provided, after the appropriate ~~time~~ delay. The ~~pilot~~  
should be able to return the rotorcraft to its normal ~~flight~~  
attitude under full manual control without exceeding the loads  
and speeds previously described and ~~without engaging~~ in any  
dangerous ~~maneuvers~~ during recovery.

(6) The following time delays should be used and are considered appropriate for the various flight regimes and maneuvers:

- (a) One to three seconds delay for cruising flight. (The time delay selected should be based upon the degree of **stability provided** and the amount of **alertness** required of the **pilot**. For example, **three** seconds are required for a fixed ~~wing~~ transport aircraft ~~in~~ **cruising flight**).

NOTE: If the improved stability and the **resultant higher** degree of relaxation by the pilot has justified **time** delays greater than one-second minimum in **cruise**, then a reexamination **is in** order of the engine failure **time** **delays used during** the original type certification prior to the **ASE** installation. (CAR **6.121(e)** and **7.121(e)**).

- (b) One second delay for climbing flight.  
(c) **Zero second delay** for takeoff, **landing**, hovering, and maneuvering flight.

(7) If **any significant loss of altitude is** experienced in any flight regime or maneuver, it **should** be provided as emergency operation **information**.

(8) The automatic stabilization **equipment should** be installed **such** that lateral, directional, and **longitudinal controllability** (CAR **6.121**) are not affected adversely; **It should** be demonstrated that with a **critical malfunction** at critical airspeeds (such as  $V_{H_0}$  and maximum **sideward** flight) it is possible for the pilot to maintain complete control **of the rotorcraft**.

(9) The automatic stabilization equipment **should** be **able** to perform its **intended** function **throughout all maneuvers appropriate to its type**. All such maneuvers should be accomplished smoothly.

(10) If **trim controls are provided** in the automatic stabilization system, they should **be** of such **design and so** installed that any failure will **not** create a hazardous condition. If an inadvertent out-of-trim condition can be developed, its effect **on the ASE or the rotorcraft should** be **investigated**. These trim controls should be such that when installed, the **controls should operate** in the plane and with the **sense** of motion of the rotorcraft. Each control means should have the **direction** of motion plainly **marked thereon or** adjacent to the control.

- (11) The automatic ~~stabilization~~ equipment should be so installed that its operation will not be adversely affected by spurious signals from other sources, or as a result of ~~normal variations~~ in the automatic stabilization system power source, or feedback by other equipment ~~operating from~~ the same power source.
- (12) A positive means should be provided to indicate to the pilot when the ~~automatic stabilization~~ equipment is ready for operation or when the ~~gyroscopic components~~ are uncaged, unless it is impossible to engage the equipment before it is ready for operation.
- (13) A visual means should be provided to indicate when the equipment is operative. If the design is such and the installation made such that it is possible to render a channel inoperative separately, then a visual means should be provided to indicate when each channel is operative.
- (14) The automatic stabilization equipment should be so installed and adjusted that the control authority for each axis can be maintained within tolerance in normal operation. These tolerances should be established and included on the aircraft specifications with the associated amount of control authority for each appropriate axis.
- (15) The following information should be provided in the rotorcraft flight manual :
- (a) Any applicable operating limitations.
  - (b) The normal operating procedures.
  - (c) The emergency operating procedures, including a statement of altitude lost in any flight regime, if it is appropriate.
- c. Although the preceding material refers to automatic stabilization equipment which may be interpreted as stability about all axes, it is intended also that this guidance material should be applicable to single axis stability augmentors, where appropriate.
- d. Approval of automatic stabilization equipment in accordance with this material does not constitute approval of the equipment or the rotorcraft for instrument flight.

  
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