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ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: ALTITUDE ALERTING DEVICES/SYSTEMS

1. PURPOSE. This circular provides guidelines for designing, installing, and evaluating altitude alerting systems.

2. CANCELLATION. Advisory Circular 91-22 dated 7 July 1969.

3. BACKGROUND. The increased number of accidents and incidents involving lack of altitude awareness prompted the FAA to initiate rulemaking (FAR 91.51) action which resulted in a requirement for an approved altitude alerting device/system on all turbojet aircraft after 29 February 1972.

4. GUIDELINES.

   a. Altitude alerting devices/systems are not considered additional primary altitude indicators or substitutes for basic altimeters nor was it intended to require these systems to serve an altitude keeping function. Accordingly, the FAA does not plan to develop restrictive specifications for this equipment. An altitude alerting device which has been shown to meet the general criteria of Appendix 1 of this circular or its equivalent may be considered for installation approval and operational use.

   b. Since the rule permits industry to accomplish the altitude alerting objective by any appropriate system or device, it is expected that various methods of complying with the rule will be presented for approval. As an example, altitude alerting devices may utilize information from: the basic altimeter system, an independent device, air data systems, radio altimeters, autopilot systems, or other systems. One system currently being installed by an air carrier utilizes barometric information to actuate visual and aural signals 1000 feet and 500 feet respectively before the preselected altitude. The assigned or desired level off altitude can be programmed into the device in 100-feet increments by the pilot setting an associated knob on the face of the instrument.

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This self-contained system, which utilizes an independent device, is just one example of a device that complies with the intent of FAR 91.51.

c. Alerting devices may be installed in accordance with existing regulations and procedures. Applicants who require operational approval of their system for compliance with FAR 91.51(b) and (c) should contact the appropriate air carrier or general aviation district office. It may be possible in some instances for the inspector to evaluate the operational capability of the alerting system on the ground, however, when making the evaluation on the ground the normal flight cockpit noise level must be considered in determining the acceptability of the audio signal. The evaluation should also include a check of the light intensity and the location of the visual signal and the altitude increments at which the signals are programmed to precede the level-off altitude. When in-flight evaluation is required the evaluation may be accomplished on training flights, flight checks, test flights, en route inspections or a combination of these flights. The alerting device should be checked at various altitudes during climb and descent, however, it need not be evaluated at the highest altitude at which the aircraft is certificated. Future demonstrations of the operational capability of the system should be made to an operations inspector or a flight test pilot.

d. There are no specific requirements for precise correlation between indications of the altitude alerting system and aircraft primary altimeter systems. In addition, there are no specific tolerances for the alerting system. The tolerances specified by the equipment manufacturers are considered acceptable if visual and aural signals occur in sufficient time to permit establishing level flight at the selected altitude. The altitude increments at which these signals are programmed to precede the level-off altitude, e.g., 1000'-500'; 800'-300', etc., should be selected and preset by the operator after considering combined aircraft and system performance characteristics. A visual signal should be located so as to be readily discernible to both pilots. In some aircraft, this may require the installation of a light on both the pilot and copilot instrument panels; however, controls for setting the alerting system need be accessible to only one pilot.

e. When a similar type of altitude alerting system is installed in accordance with existing installation regulations and procedures by an aircraft manufacturer, a repair station, an airline, or an

operator on several different types of aircraft compliance with FAR 91.51(b) and (c) would normally need to be demonstrated on one aircraft type.

f. Procedures for utilizing the system, including preflight tests to be conducted by the pilots, should be established by each operator.

Acting Director
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APPENDIX 1. ALTITUDE ALERTING DEVICES - CRITERIA FOR EQUIPMENT APPROVAL

1. APPLICABILITY. This criteria is applicable to altitude alerting devices which:

   a. Are self-contained; that is, having the pressure sensing mechanism within the case; or

   b. Receive altitude information from remote sources; and have barometric correction provisions, either integral or remote.

2. DESIGN CRITERIA.

   a. Calibration of the sensing mechanism and of the barometric pressure adjustment system with which the device operates should be to the U. S. Standard Atmosphere, 1962, and Supplements dated 1966, using as a reference a mercury barometer or static pressure generating equipment which is accurate, with corrections, to within 0.005 inches of mercury absolute.

   b. Altimeter. When incorporated as an integral part of an altimeter, the altitude alerting device should not degrade the performance of the altimeter.

   c. Maximum Altitude. The manufacturer should state the maximum altitude for which approval is sought.

   d. Preselected Altitude Display. The "selected altitude" numerical scale should be in intervals not to exceed five hundred (500) feet with incremental divisions of one hundred (100) feet.

   e. Barometric Setting. For instruments with self-contained barometric setting capabilities, the setting of barometric inputs should not cause the preselected altitude setting to change.

   f. Signal Self Test. Means should be provided to permit the pilot to test the signal generation without the use of special test equipment.

3. PERFORMANCE CRITERIA.

a. Alerting Signals. The alerting device should generate alerting signals relative to the preselected altitude level as follows:

(1) Approaching Preselected Altitude. For instruments activated by altitude sensors only, a signal should be generated to operate a visual and audio alert at an altitude setting specified by the manufacturer before attainment of the preselected altitude for both ascending and descending altitude changes. The time duration of the visual and audio alert signal relative to a change in altitude should be specified by the manufacturer. The audio signal should be of sufficient duration to operate an audio sound generator.

(2) Alert Signals. For instruments activated by altitude and rate of static pressure change sensors, a signal should be generated to operate a visual and audio alert at specific selected settings.

The alerting signals from both the altitude sensing and the altitude sensing rate of static pressure change sensor should be coordinated in their operation.

b. Altitude Departure Mode. (if provided). Signals for visual and/or audio alert should be generated for deviations above and below the preselected altitude. The alerting signal or signals should operate before the deviation has exceeded 500 feet.

c. Signal Operation Accuracy. The manufacturer should declare the altitude setting and allowable tolerances for actuation of the visual and audio alert. The alert actuation may be adjustable in which case the manufacturer should declare the range and tolerances for which the trip level may be set.

4. TEST CRITERIA.

a. RTCA Document No. DO-138 entitled "Environmental Conditions and Test Procedures for Airborne Electronic/Electrical Equipment and Instruments" dated 27 June 1968 should be used in determining the environmental conditions over which the equipment has been designed to operate. Class 2A and 2B equipment need only be tested for the environmental conditions of temperature and altitude, humidity, shock, vibration and power input voltage set forth in paragraphs 4, 5, 6, 7, and 9 of DO-138. DO-138 may be examined at any FAA Regional Office of the Chief, Engineering and Manufacturing Branch (or, in the case of the Western Region, the Chief, Aircraft Engineering Division). The document may be obtained from the RTCA Secretariat, Suite 655, 1717 H Street NW., Washington, D.C. 20006.

b. In addition to the above tests, the following case leak test must be performed as applicable: for devices with self-contained pressure sensing elements, the static pressure port should be connected to a pressure sensing indicator and a source of vacuum. A vacuum should be applied to approximate an altitude of 18,000 feet and then shut off for a period of one minute. The pressure change should not exceed the equivalent of 100 feet.