



CIVIL AVIATION ADVISORY PUBLICATION

CAAP 53

CLARIFICATION ON ILS CONTINUITY TESTING, ILS FLIGHT CALIBRATION PERIODICITY AND THE MANAGEMENT OF ILS ABNORMAL STATES

GUIDANCE AND INFORMATION FOR AIRPORT OPERATORS AND PROVIDERS OF CNS FACILITIES ON ILS ISSUES

1. PURPOSE

The purpose of this Civil Aviation Advisory Publication (CAAP) is the Clarification on ILS Continuity Testing, ILS Flight Calibration Periodicity and the Management of ILS Abnormal States and to ensure consistency in the management of some aspect of ILS systems in Yemen.

2. STATUS OF THIS CAAP

This is the first issue of CAAP 53 and is dated January 2019. It will remain current unless withdrawn or superseded.

3. APPLICABILITY

This CAAP is applicable to all operators of international airports and providers of CNS facilities in Yemen.

4. References

- ICAO Annex 10 to the Convention on International Civil Aviation, Volume 1.
- ICAO Doc. 8071 "Manual on the Testing of Radio Navigation Aids".

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6. DEFINITIONS

Reliability- The probability that a system will operate within the specified tolerances.

Integrity- The probability that a system will not radiate incorrect navigation guidance information.

Continuity of Service - The probability that a system will not fail to radiate navigation guidance information during a defined time interval.

Outage- The failure of a system to radiate navigation guidance.

New System Type - A type of installation not yet in use in Yemen.

Subsequent System - A system identical to type that has been previously approved.

7. ABBREVIATIONS

CNS: Communications, Navigation, Surveillance

EASA: European Aviation Safety Agency

FAA: Federal Aviation Administration

ICAO: International Civil Aviation Organization

ILS: Instrument Landing System

MTBF: Mean Time between Failures

MTBO: Mean Time between Outages

SARPs: ICAO Standards and Recommended Practices

UK CAA: United Kingdom Civil Aviation Authority

8. ILS CONTINUITY TESTING REQUIREMENTS

8.1. Introduction

The objective of this CAAP is to provide guidance on requirements for continuity testing of ILS systems. This CAAP takes cognisance of approval processes carried out by other States for established systems. This should result in less duplication of work, and more effective methods of putting new systems into service, thus reducing the effort required by both the Authority and the CNS provider.

8.2. Approval of New System Types

8.2.1. Type Approval

Type approval is a series of tests and verifications which are normally only performed once for a particular build state or design of system. The type approval process also includes an assessment of the manufacturer's quality and support procedures to ensure controlled and repeatable production techniques. Certain type approval tests may need to be repeated if the system is subsequently modified. For type approval testing, it is normal practice to install the system on a site that is reasonably clear of any obstructions which could affect the radiated signals. Extensive ground and flight tests should be made to ensure that all parameters of the radiated signal are compliant with ICAO Annex 10 SARPs. Guidance for conducting these tests may be found in ICAO Doc 8071 and guidance for evaluating the results is available in Doc 8071 and in the Attachments to Annex 10. These type approval tests will normally be more comprehensive than those carried out at commissioning. Long term performance measurements should be made to determine the stability of key parameters in an operational environment. The results of type approval tests carried out by FAA, UK CAA or EASA can be used for operational approval of a new system to Yemen, providing they have covered a range of environments encountered in Yemen and similar systems are in operational use. The MBTO data shall be provided and verified by the Authority.

8.2.2. Continuity of Service

For new systems that are not type approved by the FAA, UK CAA or EASA, tests shall be carried out as per the figures in Table 1.

Level	Runway	Integrity	Continuity	MTBO (Hours)
1		Not demonstrated, or less than required for Level 2		
2	CAT I	1 - 1×10^{-7} in any one landing	1 - 4×10^{-6} in any period of 15 seconds	1000
3	CAT II/IIIA	1 - 0.5×10^{-9} in any one landing	1 - 2×10^{-6} in any period of 15 seconds	2000
4	CAT IIIB/C	1 - 0.5×10^{-9} in any one landing	1 - 2×10^{-6} in any period of: 30 seconds (LOC) 15 seconds (GS)	4000(LOC) 2000 (GS)

Table 1- Minimum Localizer (LOC) and Glide Slope (GS) Integrity and Continuity Levels for New Systems

For systems that evidence of the appropriate type approval can be provided the figures contained in Table 2 shall apply. These figures also apply to subsequent types of system. They are primarily to ensure the quality of installation meets the required standards.

Level	Runway	Integrity	Continuity	MTBO (Hours)
1		Not demonstrated, or less than required for Level 2		
2	CAT I	1 - 1×10^{-7} in any one landing	1 - 4×10^{-6} in any period of 15 seconds	24
3	CAT II/IIIA	1 - 0.5×10^{-9} in any one landing	1 - 2×10^{-6} in any period of 15 seconds	360
4	CAT IIIB/C	1 - 0.5×10^{-9} in any one landing	1 - 2×10^{-6} in any period of: 30 seconds (LOC) 15 seconds (GS)	720(LOC) 360 (GS)

Table 2- Minimum Localizer (LOC) and Glide Slope (GS) Integrity and Continuity Levels for Subsequent Systems

Additional information on integrity and continuity of service is contained in Attachment C to Part 1 of the ICAO Annex 10, Volume I.

8.2.3. In Service Continuity of Service Monitoring

Once a system is in service the MTBO should be continually monitored. A system showing degradation in continuity of service may have to be operated at a lower category or withdrawn from service until the cause has been rectified and sufficient confidence has been gained. For single equipment the MTBO equals the MTBF, but in dual systems which are commonly used for Category II/III operations the MTBO is not equal to the MTBF. Dual systems are used due to single equipment not being able to achieve the required MTBO and/or to increase the availability of the system. At first glance the MTBF may not look as important as the MTBO of the system. The MTBF requirement is not stated as such in the ICAO Annex 10, but if parts of the equipment not leading to an unanticipated interruption of the signal in space because the equipment switches over to the standby transmitter following a fault, result in a low MTBF of the system this may lead to a decrease of the integrity of the system. This is especially the case, when the individual monitor system parts have a low MTBF. For this reason the MTBF of the system should be continually monitored.

8.2.4. Restoration to Service of Repaired and/or Modified Systems

Maintenance and repair to systems may range from minor component to full antenna and transmitter replacement as well as modifications of the system. The assessment of the impact of maintenance and repair to a system will require careful consideration as to the type of component and the function performed by it.

8.2.5. Replacement of identical components

Following replacement of identical components a review of the installation is required. This is to ensure that the installation has stabilized and that other components have not been affected. Depending on the extent of repair work, a test period is recommended before restoring the system back to Category II or III operation. The length of this period is to be based on sound engineering judgment. If the failure occurred in a non-redundant part of the system or caused a signal outage, a minimum test period of 12 hours is suggested and it is recommended that 24 hours elapse prior to returning to Category II or III.

8.2.6. Modifications of the system

Modifications can range from minor changes to effectively a new system. The relative assessment of the change, taking into account the current regulations is a subjective decision based on sound engineering judgement. Any modification shall be reviewed and is subject to CAR part VIII and part IX processes by the Authority before re-introduction to service and phased re-classification in category of operation. In order to assess the influence the modification has on system performance, it is essential that the modification be carefully documented. This should include a proper safety case and test plan submitted to the Authority before commencing the tests.

9. Periodicity of Flight Calibration of ILS systems

Many factors influence the choice of appropriate intervals for both ground and flight tests. These include the reliability and stability of operation of the equipment, the extent of ground monitoring, the degree of correlation between ground and flight measurements, changes in the operating environment, manufacturer recommendations, and the quality of maintenance. Given that the reliability and stability of the latest equipment designs and provided the following criteria are met:

- (a) good correlation between concurrent ground and airborne results;
- (b) a record of independent monitor calibration results;
- (c) a record of equipment monitor readings taken at least at monthly intervals;
- (d) evidence that the quality of the maintenance is high; and
- (e) the facility is adequately safeguarded against changes in the operational environment, e.g. building development.

The periodicity of Flight Calibration intervals for ILS systems shall be **180 Days ±20** subject to the Authority's Approval.

All flight inspections shall be carried out in accordance with ICAO Doc 8071

10. ILS Abnormal Situation Checklist

Component	Situation	CAT	Effect	Action Requirement
Localizer (LOC) and Glide Slope (GS)	One transmitter is inoperative.	I	No effect	Corrective maintenance
		II	No effect if one transmitter fails during CAT II operations. See NOTE 1.	Expedite corrective maintenance
		III	Denies CAT III operations NOTE 1: Should weather improve to CAT I for at least four hours and subsequently deteriorate to CAT II/III conditions, standby equipment shall be restored prior to resuming CAT II/III operations.	The facility/organization responsible shall ensure that appropriate NOTAM action is taken, and expedite corrective maintenance.
Far Field Monitor (FFM) Sensor(s)	At least one sensor (receiver subsystem) operating & not in alarm	All	No effect	Corrective maintenance
	All sensors (receiver subsystems) inoperative or in alarm	All	If ILS critical areas are known to be clear, continue operations. Should weather improve to CAT I for at least four hours and subsequently deteriorate to CAT II/III conditions, FFM sensor(s) shall be restored prior to resuming CAT II/III operations. (NOTE: FFM installation not required for CAT I operations; if installed, however, use the preceding text.)	Cat I -- Corrective maintenance Cat II & III --Expedite corrective maintenance

FFM Remote Monitoring Indicator	Status indications not available or abnormal (e.g., remoting lines out of service, FFM bypassed); NOTE: These indications typically have time delays of 15-120 seconds.	All	If ILS critical areas are known to be clear, continue operations. Should weather improve to CAT I for at least four hours and subsequently deteriorate to CAT II/III conditions, FFM sensor(s) shall be restored prior to resuming CAT II/III operations. (NOTE: FFM installation not required for CAT I operations; if installed, however, use the preceding text.)	Cat I -- Corrective maintenance Cat II & III --Expedite corrective maintenance
LOC or GS Executive (Integrity) Monitors (excludes FFM function)	One monitor in a dual-channel system fails, reducing system integrity level.	I II III	No effect (dual monitors not required) No effect if fails during CAT II operations. Should weather improve to CAT I for at least four hours and subsequently deteriorate to CAT II conditions, failed monitor shall be restored prior to resuming operations. Denies operations	Corrective maintenance Expedite corrective maintenance Initiate NOTAM action and expedite corrective maintenance
Outer Marker Beacon (OM); Distance Measuring Equipment (DME)	Inoperative	All	If the final approach fix (FAF) can be identified by one or more of these facilities and/or another NAVAID (e.g., radar), or published waypoint, there is no effect. If the FAF cannot be identified (e.g., no method available for timing of descent), non-precision operations cannot be conducted.	Notify aircraft; initiate NOTAM action and corrective maintenance
Middle Marker Beacon (MM)	Inoperative	All	No effect	Notify aircraft; initiate NOTAM action and corrective maintenance
Inner Marker Beacon (IM)	Inoperative	All	No effect	Notify aircraft; initiate NOTAM action and corrective maintenance

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