CIVIL AVIATION SAFETY AUTHORITY AUSTRALIA

Advisory Circular

AC 139-04(0) SEPTEMBER 2003

COMMISSIONING OF AERODROME LIGHTING SYSTEMS

CONTENTS

Advisory Circulars are intended to provide recommendations and guidance to illustrate a means but not necessarily the only means of complying with the Regulations, or to explain certain regulatory requirements by providing interpretative and explanatory material.

Where an AC is referred to in a 'Note' below the regulation, the AC remains as guidance material.

ACs should always be read in conjunction with the referenced regulations

1. REFERENCES

- CASR 139.200 – Checking of lighting systems.
- MOS-Part 139 subsection 9.1.15 – Commissioning of Lighting Systems.

2. PURPOSE

This Advisory Circular (AC) provides general information and advice on the requirements and method of commissioning various aerodrome lighting systems. For those systems that require a flight check as part of the commissioning process, advice on the conduct of the flight check is also provided.

3. STATUS OF THIS AC

3.1 This is the first AC to be issued on this subject.

3.2 The content of this AC consolidates and updates information previously published in various documents. As such, this AC replaces the following documents:

- CAAP 89T-1(0) – Commissioning of PAPI approach slope indicator system.
- CAAP 89T-2(0) – Flight checking of aerodrome lighting systems.

4. GENERAL

4.1 CASR 139.200 requires that, at a certified aerodrome, new lighting systems must not be put into service unless they have been appropriately checked, as follows:

(a) a ground check:

(i) by an electrical engineer or a licensed electrician, to check for compliance with electrical specifications and technical standards set out in the Manual Of Standards (MOS)-Part 139 Aerodromes;

(ii) by a person with a degree, diploma or certificate in surveying or civil engineering, or experience and competence in surveying acceptable to CASA, to check for those elements of compliance that require the use of survey instruments, for example the angular light beams of a visual approach slope indicator;

(b) a flight check, by an approved pilot.

4.2 CASR 139.200 identifies the following lighting systems as requiring both a ground check and a flight check:

(a) an approach lighting system;

(b) a runway lighting system for instrument approach runways;

(c) a visual approach slope indicator system for jet-propelled aircraft (other than for a system intended for use on a temporary basis for a period not longer than 30 days);

(d) a pilot-activated lighting system (PAL).

4.3 MOS-Part 139 subsection 9.1.15 explains in more detail the commissioning of lighting systems, including the requirement that all those lighting systems not identified as requiring both a ground check and a flight check, must have the ground check prior to commissioning.

4.4 The aerodrome operator is responsible for submitting documentation supporting commissioning to the relevant CASA office whose area of responsibility encompasses the aerodrome. MOS-Part 139 subsection 9.1.15 provides details.

5. GROUND CHECK – GENERAL PROCEDURES

5.1 The ground check is to ensure the lighting system, as installed, complies with the relevant specifications and standards, as detailed in the MOS-Part 139.

5.2 A ground check report is to be prepared by the person(s) conducting the check. Because of the wide variety of possible checks to be performed, no particular format is suggested for the general ground check report, but all checks performed are to be itemised in the report. The report should detail all the checks made, and any necessary corrective action as a result of the checks. Where appropriate, the person(s) conducting the check is to certify that the installation of the lighting system meets the relevant specifications and standards.

5.3 Ground check reports should be provided to the aerodrome operator, for their use as a document supporting commissioning. CASA inspectors may subsequently refer the ground check reports as part of the on-going surveillance of the aerodrome.

5.4 As a minimum, the following should be checked and confirmed:

(a) the scale of lighting systems is at least the minimum required, is appropriate to the type of operations intended to be conducted, the complexity of the aerodrome layout and the traffic density;

(b) the power supply, including primary source, secondary source, switchover time, and electrical circuitry, are in accordance with the relevant standards;

(c) light fixtures are in accordance with the relevant standards, and are fit for the purpose. For checking compliance with photometric standards, the use of certified test results from appropriately qualified third parties is acceptable;

(d) light fixtures are correctly located, including spacing, pattern, alignment, and levelling. Methods of mounting or attachment are such that fixtures can not move and thus become out of alignment or level;

(e) colour of light is correct (because of some of the technologies used to produce coloured light, the lights must be turned on for this check.). For checking compliance with chromaticity standards, the use of certified test results from appropriately qualified third parties is acceptable;

(f) the installation does not pose a hazard to aircraft; equipment and mountings are frangible; footings and foundations do not extend above the surrounding ground level;

(g) overall condition of the installation; cleanliness of optical surfaces; removal of construction materials and potential “foreign object damage” materials; reinstatement and consolidation of surfaces that were disturbed or excavated.

5.5 Control of lighting systems should be confirmed as working correctly. Remote control and monitoring, including fault indication, provided to Control Towers, should be fully exercised and confirmed, including any interlocks present. Current settings should be measured and recorded, (with true RMS instruments). Where light-sensitive switches are incorporated into control systems, their location should be checked to ensure correct operation, free from the effect of any artificial lights in the vicinity.

5.6 The ground check of visual approach slope indicator systems, PAPI and T-VASIS, should also include the additional aspects contained in Sections 6 or 7, below.

6. GROUND CHECK - PAPI

6.1 The ground check is to measure and confirm position, alignment, and light beam angles. It should be carried out in such a way that the normal aircraft operations at the aerodrome are not affected.

6.2 The results of the ground check should be recorded for inclusion with the documentation supporting commissioning. A suggested form for recording the results of a PAPI Ground Check is included as Appendix I. When identifying individual PAPI units, the naming convention shown in MOS-Part 139 Chapter 9, *"Figure 9.9-6: The Arrangement of a PAPI System and the Resulting Display"*, is to be used.

6.3 Before conducting the ground check survey, the surveyor needs to obtain from the aerodrome operator or the PAPI installation designer, the following design details:

(a) the aircraft on which the design was based and, which of the four eye-to-wheel height group that aircraft is in;

(b) the design wheel clearance over the threshold;

(c) the design approach angle;

(d) the resultant minimum eye height over threshold (MEHT), used in the design;

(e) the critical obstacle within the approach surface, if any.

6.4 Check that the PAPI system has appropriate multiple intensity stages, and that they operate correctly. If there is a maintenance intensity stage provided (typically with current setting of approximately 2.8 amps), this will allow maintenance technicians and ground surveying staff to look into the PAPI units from reasonably close range. If a maintenance intensity stage is not provided, the lowest available intensity stage should be used during the conduct of the ground survey, but the viewing distance in front of the PAPI unit will have to be increased, and this in turn will result in the line of sight being at a higher level above the ground, and the viewer will have to be on a high platform such as a cherry picker.

Note: When the maintenance intensity setting has been used, ensure that the control equipment is re-set to normal operation, following maintenance and/or ground survey checks.

6.5 Check that the PAPI has been located in accordance with the design, particularly in regard to PAPI light spacings, alignment, and distance from the threshold. Any special mounting heights specified in the siting design should be confirmed, as should minimum clearances from pavements. Levelling of the light units should be confirmed with the precision instruments appropriate to the particular type of equipment. Alignment of lamps within the light units should be confirmed in accordance with methods specific to the type of equipment. Foundations should be examined and an assessment made of their stability.

6.6 Light Beam Vertical Colour Transition Angles. The following procedures have proved satisfactory. If alternative methods are used, details should be provided in the Ground Check Report:

(a) it should be noted that the colour of the light beam does not change abruptly from red to white (but the colour transition from red to white in the vertical plane must be in compliance with MOS-Part 139 paragraph 9.9.4.6(b)). The actual angle of colour transition is the average of 2 readings: the mid-point between the highest point at which red only can be seen, and the lowest point at which white only can be seen;

(b) set the theodolite on or over the PAPI unit being checked. Measure the distance (*x*) between the center of the light beam and the center of the theodolite telescope;

(c) a survey assistant holding a staff with a moveable marker is stationed 30-50 m (but see paragraph 6.4) in front of the PAPI unit. The marker is fixed at the point where the assistant determines that the colour of the light changes from red to white, in accordance with paragraph 6.6(a);

(d) the marker is then raised vertically for a distance (*x*). The surveyor reads the vertical angle to the marker with the theodolite;

(e) to confirm this reading, the assistant moves to another location in front of the same PAPI unit, and repeats the process, to obtain a second reading; and

(f) the process (b) to (e) is repeated for each of the PAPI units.

6.7 The colour transition angles should comply with the following, based on a standard 3° approach slope.

PAPI Unit	Without an ILS	Harmonized with an ILS
A	2° 30' ± 3'	2° 25' ± 3'
B	2° 50' ± 3'	2° 45' ± 3'
C	3° 10' ± 3'	3° 15' ± 3'
D	3° 30' ± 3'	3° 35' ± 3'

6.8 Light Beam Horizontal Spread. The survey assistant moves laterally towards the runway from the extended centerline of each PAPI unit, until the light is just not visible. The surveyor then measures the horizontal angle of that position. The process is repeated with the survey assistant moving away from the runway. Repeat this process for each PAPI Unit.

Note: If there is a restriction on the azimuth spread, for example due to the presence of an obstacle, the surveyor should direct the assistant to move to the limit of the azimuth restriction, and the assistant should confirm that the light beam can not be seen from that position.

6.9 Obstacle Clearance Check. Set up the theodolite at one end of the Obstacle Assessment Surface (OAS) base line, which is 60 m before the threshold. With the theodolite vertical angle set to the OAS slope angle, confirm no obstacles penetrate the OAS. Move the theodolite to the other end of the OAS baseline, and repeat the procedure. If a particular obstacle was identified as a critical obstacle for the design of the PAPI, with the theodolite positioned on the OAS baseline and on the extended runway centerline, measure the angle to the top of the obstacle.

6.10 Overall System Check. A pilot's view of the PAPI system can be simulated by viewing the system from height from a cherry picker located an appropriate distance in front of the system. (The distance in front of the system is a function of the height reach of the cherry picker available.) The following checks should be made:

(a) the light units appear to be in a horizontal line;

(b) the light units appear to be of uniform intensity on all daylight settings;

(c) for the night intensity stages, the intensity of the PAPI units is visually compatible with the runway edge lights and the threshold lights;

(d) the colour transition of the individual PAPI units changes in a uniform progression as the viewing position is raised / lowered.

6.11 This overall system check is not critical when a flight check is also to be conducted, but for those PAPI installations where a flight check is not going to be conducted, this overall system check should be carried out wherever practicable.

7. GROUND CHECK – T-VASIS

7.1 The ground check is to measure and confirm position, alignment, and level of T-VASIS boxes, and also the light distribution within each T-VASIS box. It should be carried out in such a way that the normal aircraft operations at the aerodrome are not affected.

7.2 The results of the ground check should be recorded for inclusion with the documentation supporting commissioning. A suggested form for recording the results of a T-VASIS Ground Check is included as Appendix II. When identifying individual T-VASIS boxes, the naming convention shown in MOS-Part 139 Chapter 9, *"Figure 9.9-2: T-VASIS Layout"*, is to be used.

7.3 Before conducting the ground check, the person conducting the check needs to obtain from the aerodrome operator or the T-VASIS installation designer, the following design details:

(a) the design eye-height over threshold;

(b) the design approach angle;

(c) any design variations from the standard layout;

(d) the design layout showing T-VASIS box locations, and any specified mounting pillar heights;

(e) the critical obstacle within the approach surface, if any.

7.4 Check that the T-VASIS system has appropriate multiple intensity stages, and that they operate correctly.

7.5 Check that the T-VASIS has been located in accordance with the design, and that alignment is within tolerance. Any special mounting heights specified in the siting design should be confirmed, as should minimum clearances from pavements.

7.6 Check the level of each T-VASIS box.

- The accuracy of the precision level can be affected by thermal expansion, therefore level checking should not be carried out during hot sunny days; or alternatively, the level should be shaded from the sun while in use.
- Rough handling of the precision level can cause incorrect indication. Check the accuracy of the precision level by "end-for-ending" it, and noting the bubble indication.
- Check the level across the front of the T-VASIS box. Then check the level front-to-rear on each side of the box.
- Repeat the level check for each T-VASIS box in the system.

7.7 The foundations should be examined and an assessment made of their stability.

7.8 Check the lamp alignment in each T-VASIS box. Protective eyewear such as welders' goggles should be used by the observer when looking into the incident light.

- Select maximum day intensity, then from a position approximately 10 m in front of the T-VASIS box and on its centerline, check that the lamps present the maximum flashed area.
- The technique for doing the observations for a fly-up box is to look into the light source from above the cut-off and come down into the main beam. For a fly-down box, observe from below cut-off and come up into the beam. For a bar box, the inner day lamps should appear to be full on above the red filter and the outer day lamps full on through the red filter.
- When the lamp is correctly aligned the first small portion of incident light should appear to the observer as a continuous white line, not dotted. At the same time check that the signal cuts "on" or "off" over the whole width of the aperture and does not appear to "slide" across as the observer raises or lowers his eyes. Observe that the intensities are consistent across the full width of the beam.
- On completion of the day lamp alignment check of a box, select maximum night intensity and check that the night lamps present the maximum flashed area. The fly-up and fly-down boxes use the same procedure as for day lamps, with the main beam peaking as the light beam is first observed. The night lamps on a bar box are to be fully flashed just above the edge of the red filter.

7.9 Check the light beam horizontal spread. Set up the theodolite on or over the centre rear of the T-VASIS box. Have the survey assistant move laterally towards the runway from the extended centerline of each box, until the light is just not visible. The surveyor then measures the horizontal angle of that position. The process is repeated with the survey assistant moving away from the runway. Because T-VASIS have different azimuth spread for day- and night- intensity, this check should be done twice: with day intensity selected and again with night intensity selected. Repeat this process for each box.

Note: If there is a restriction on the azimuth spread, for example due to the presence of an obstacle, the surveyor should direct the assistant to move to

the limit of the azimuth restriction, and the assistant should confirm that the light beam can not be seen from that position.

7.10 Check obstacle clearance. Set up the theodolite at one end of the OAS base line, which is 60 m before the threshold. With the theodolite vertical angle set to the OAS slope angle, confirm that no obstacles penetrate the OAS. Move the theodolite to the other end of the OAS baseline, and repeat the procedure. If a particular obstacle was identified as a critical obstacle for the design of the T-VASIS, with the theodolite positioned on the OAS baseline and on the extended runway centerline, measure the angle to the top of the obstacle.

8. FLIGHT CHECK – APPROVAL TO CONDUCT

8.1 A pilot who wishes to conduct a flight check of aerodrome lighting systems at an aerodrome should contact the relevant CASA office whose area of responsibility encompasses the aerodrome, to either:

(a) seek approval; or

(b) provide evidence of previous CASA approval.

8.2 An application for approval to conduct a flight check of aerodrome lighting systems will be assessed by a CASA Flying Operations Inspector (FOI). Before granting an approval, he or she will need to be satisfied that the applicant has the following attributes:

(a) knowledge of the relevant lighting standard and how the lighting system supports aircraft operations;

(b) understanding of the objectives of the flight check and parameters to be checked;

(c) demonstrated experience in low level flying operations;

(d) adequate flying skills and experience to organize and conduct the checks safely, effectively and with minimum disruption to other airspace users.

8.3 The approval process may include an interview, and demonstration flight.

8.4 Approvals given will be in the form of a letter of confirmation of competency to conduct flight checks of aerodrome lighting systems. Validity of the letter will be for a finite period, usually three years, subject to renewal.

Note: An air operator's certificate is not a requirement for flight checks of aerodrome lighting systems by individuals who have been assessed and granted approval by CASA.

9. FLIGHT CHECK – GENERAL PROCEEDURES

9.1 For ease of presentation, a series of steps for checking the lights are set out below. Providing all checks are completed, it is not necessary that the steps be followed in numerical order. Also, with experience, some of the steps may be combined resulting in a reduction in the number of approaches flown.

9.2 Where the lighting system is intended for day and night use, flight checks will need to be conducted during the day and at night.

9.3 Flight checks should not be conducted in weather conditions worse than cloud ceiling of 1500 feet and visibility less than 10 km.

9.4 While flight checks are being conducted, a ground party, consisting of the aerodrome installation or maintenance electrical staff, should be present. The ground party should have the necessary tools, test equipment, and expertise, to make adjustments to the lighting, as requested by the pilot, during the flight check.

9.5 A flight check report is to be prepared by the pilot, for all flight checks conducted, including those checks that found the lighting system to be deficient or unacceptable.

9.6 Where appropriate, the pilot conducting the flight check is to certify that the performance of the lighting system meets operational requirements for commissioning. The report should detail all the checks made, including description of all the approaches flown, and any necessary corrective action as a result of the flight checks. Suggested flight check report forms are included as Appendixes III, IV, V, and VI.

9.7 Flight check reports should be provided to the aerodrome operator, for inclusion with the documentation supporting commissioning. CASA inspectors may subsequently refer the flight check reports as part of the on-going surveillance of the aerodrome.

10. FLIGHT CHECK – RUNWAY EDGE, THRESHOLD, & RUNWAY END LIGHTS, AND ASSOCIATED LIGHTS

10.1 For each runway direction, check that the runway edge, threshold and runway end lights show a uniform pattern during take-off, landing, and going around. Check that the colour of the lights is correct. Check that there is a progressive and even reduction in the intensity of the lights as the aircraft leaves their area of primary cover.

10.2 Fly the circuit at low level at dusk or dawn (i.e. with light sufficient to avoid any obstacles but dim enough to see the lights) and approach each end of the runway to determine that the visual cues provided by the lights are adequate for a visual circuit and that the lights clearly define the runway.

10.3 Carry out a normal approach from approximately 4 nm, initially with the runway lights at maximum intensity setting. Call for progressive reductions in light intensities down to the minimum setting. Check that all lights respond correctly and simultaneously to the setting changes, and that any period of light extinction between intensities is sufficiently brief as to be operationally acceptable. At a low intensity setting, carry out a low go-around and note and record any light outages or misalignment.

10.4 Whilst on the runway, check that from a height of 3 m above the runway surface, there is an unobstructed line of sight to runway edge and runway end lights within 600 m.

10.5 Taxiway lights

10.5.1 Check that taxiway lights provide adequate and un-ambiguous guidance.

10.5.2 Check that the colour of the taxiway lights is correct.

10.5.3 Check that taxiway lighting, including turning node lighting, does not cause any confusion to aircraft surface movements.

10.5.4 Where runway guard lights, intermediate holding position lights, or stop bars, are provided, check that they are clearly visible from the taxiway when approaching the holding position, and that the location, pattern, colour, flashing characteristic, etc., are correct.

10.6 Movement Area Guidance Signs (where provided)

10.6.1 Check that the signs are clearly visible and the inscriptions are legible from runways and taxiways at a sufficient distance prior to the sign, to enable safe aircraft surface movement, by both day and night.

10.6.2 Check that the colours of the signs are correct.

10.7 Illuminated Wind Direction Indicators

10.7.1 Check that the illuminated wind direction indicator(s) (IWDI) are conspicuous from the approach, the circuit area, the apron and the runway threshold.

10.7.2 Assess that IWDI will show a true representation of surface wind in the vicinity of the runway(s), and not be adversely affected by adjacent structures, trees, etc.

10.7.3 Check that the floodlights on the IWDI do not cause glare to a pilot approaching to land, or on the movement area.

10.8 Apron Floodlights

10.8.1 Check that the apron floodlights provide adequate illumination on the apron to maneuver, load/unload, and fuel aircraft, as appropriate.

10.8.2 Check that the apron floodlights do not cause glare to a pilot circling, approaching to land, or on the movement area.

10.9 Aerodrome Environment

10.9.1 Check obstacle lights in the vicinity of the aerodrome for operating effectiveness, and for any that are not operating.

10.9.2 Check for the presence of extraneous lights on and within 6 km of the aerodrome which may cause confusion.

10.9.3 Where an aerodrome beacon is provided, check that it is not visually shielded by objects, does not cause dazzle, flashes at the correct rate, has the correct colour light flashes, and the approximate range at which it can be seen.

11. FLIGHT CHECK – APPROACH LIGHTS

11.1 Carry out a normal ILS approach from 4 nm starting with all the approach lights at maximum intensity setting. Confirm that the pattern is correct: either Cat I, or Cat II/III, and for Cat II/III systems check that the colour of the side row barrettes is correct. Check that the lights show a uniform pattern. Vary the approach path: a small variation in elevation and azimuth should not present any noticeable change in the intensity of the lights. A large variation should produce a progressive reduction in intensity as the aircraft leaves the area of primary coverage of the lights. These changes in intensity should be similar for all lights. Irregular changes indicate incorrect setting angles of individual light units and should be noted for corrective action on the ground.

11.2 During the approach call for the progressive reduction in intensity down to the minimum setting. Check that all lights respond correctly and simultaneously to the intensity setting changes, and that any period of light extinction between intensities is sufficiently brief as to be operationally acceptable.

11.3 With both the approach lights and the runway lights selected to the same intensity stage, check that the intensity of the approach lights is visually compatible with the runway edge lights and the threshold lights. Repeat this check for all intensity stages.

Note: While the approach lights will be brighter than the runway and threshold lights, they should not visually dominate them.

11.4 With the approach lights set at a suitable intensity setting (the lowest at which the lights are discernible is normally best), check that all the individual lights are illuminated. Note and record any light outages or misalignment.

12. FLIGHT CHECK – RUNWAY CENTRELINE LIGHTS

12.1 Carry out a normal ILS approach from 4 nm starting with the runway centreline lights at maximum intensity setting. Confirm that the pattern is correct, and uniform. (It may be easier to observe this if the runway edge lights are extinguished while making this check.) Check that the colour/pattern of the last 900 m of centerline lighting is correct.

12.2 During the approach call for the progressive reduction in intensity down to the minimum setting. Check that all lights respond correctly and simultaneously to the intensity setting changes, and that any period of light extinction between intensities is sufficiently brief as to be operationally acceptable.

12.3 With both the runway centre line lights, the approach lights and the runway edge lights all selected to the same intensity stage, check that the intensity of the runway centre line lights is visually compatible with the other lighting systems. Repeat this check for all intensity stages.

12.4 With the runway centre line lights set at a suitable intensity setting for the prevailing visibility, (and the runway edge lights also on to the corresponding intensity), carry out an approach, landing, and roll-out to the far end of the runway. Check the adequacy of visual cues, and absence of dazzle. Check that all the individual lights are illuminated. Note and record any light outages or misalignment.

13. FLIGHT CHECK – RUNWAY TOUCHDOWN ZONE LIGHTS

13.1 Carry out a normal ILS approach from 4 nm starting with the runway touchdown zone lights at maximum intensity setting. Confirm that the pattern is correct, and uniform.

Note: It may be easier to observe this if the runway edge lights are extinguished, but the approach lights and runway centre line lights are illuminated, while making this check.

13.2 During the approach call for the progressive reduction in intensity down to the minimum setting. Check that all lights respond correctly and simultaneously to the intensity setting changes, and that any period of light extinction between intensities is sufficiently brief as to be operationally acceptable.

13.3 With both the runway touchdown zone lights, the runway centerline lights, the approach lights and the runway edge lights all selected to the same intensity stage, check that the intensity of the runway touchdown zone lights is visually compatible with the other lighting systems. Repeat this check for all intensity stages.

13.4 With the runway touchdown zone lights set at a suitable intensity setting for the prevailing visibility, (and the approach lights, the runway centreline lights and the runway edge lights also on the corresponding intensity), carry out an approach, landing, and roll-out to at least beyond the far end of the touchdown zone lights. Check the coherence of the visual pattern, (but not the colour), provided by the Cat II/III approach light side row barrettes and the touchdown zone light barrettes. Check for the absence of dazzle. Check that all the individual lights are illuminated. Note and record any light outages or misalignment.

14. FLIGHT CHECK - PAPI

14.1 The flight check is to confirm the system usability. The system is usable if it can be seen and interpreted at a sufficient distance prior to the threshold; the colour changes are sharp; the colour change increments are uniform; and the indicated approach slope is compatible with that provided by other approach aids such as an ILS, where they are co-located.

14.2 A suggested form for recording the results of a PAPI flight check is included at Appendix IV. When identifying individual PAPI units, the naming convention shown in MOS-Part 139 Chapter 9, *"Figure 9.9-6: The Arrangement of a PAPI System and the Resulting Display"*, is to be used.

14.3 Day check. Where possible the day check should be carried out in bright sunlight to confirm the visual acuity of the PAPI in the most demanding visual conditions:

(a) with the PAPI on maximum intensity stage, position the aircraft at approximately 5 NM from the threshold at 1200 ft AGL on the approach to the runway. Hold this altitude and make a qualitative check of the system to determine that there are no obvious deficiencies such as lights not operating. Check that:

  (i) the lights appear of uniform intensity throughout the system;

  (ii) the lights appear to be in a straight line, in a horizontal plane;

  (iii) the signal changes from red to white is sharp and appears to occur instantly;

  (iv) the colour change sequence is even; and

  (v) where a PAPI is on both sides of the runway, the colour change of corresponding opposite units is coincident;

(b) during the approach call for the progressive reduction in intensity. Check that all lights respond correctly and simultaneously to the intensity setting changes, and that any period of light extinction between intensities is sufficiently brief as to be operationally acceptable. Select the intensity stage appropriate for the ambient conditions for the remainder of the checks.

(c) commence the next approach from approximately 5 NM from the threshold at 1200 ft AGL. Intercept the visual glide path and note the maximum range at which an on-slope indication can be clearly recognized, i.e. the difference between the red and white lights is clearly discernible. The minimum acceptable range is 4 NM in good visibility. While maintaining an "on-slope" indication, note the system sensitivity.

Note: A correctly adjusted system provides a less sensitive indication of "on-slope" than the T-VASIS. There is approximately 17 ft between "3 red" and "3 white" at the threshold. This difference is approximately 213 ft at 2 NM.)

14.4 Compatibility with Non-visual Aids. Where an instrument glidepath is available, carry out an instrument approach maintaining the glidepath. Check that the PAPI indicates "on-slope" from a range of 4 NM to the threshold. (Note: The ILS glidepath should be near the lower limits of the PAPI "on-slope" signal if an aeroplane with a small eye-to-aerial height is used.)

14.5 Obstacle check. From a range slightly beyond 4 NM, fly an approach sufficiently low so as to be just within the all-red indication, i.e. the fourth light unit is indicating just red. Hold this indication throughout the approach and check that there are no obstacles throughout the azimuth coverage of the light beams.

14.6 Night check. From a range of approximately 4 NM, fly an approach with both the PAPI and the runway lights on. Call for the progressive reduction in intensity of the lower intensity stages. (Stages 4 to 1 for a 6-stage installation, or Twilight and Night intensity for a 3-stage installation.) Check that:

(a) all PAPI lights respond correctly and simultaneously to the intensity setting changes; and

(b) the intensity of the PAPI is visually compatible with the runway edge lights and the threshold lights for each of the relevant intensity stages.

15. FLIGHT CHECK – T-VASIS

15.1 The flight check of a T-VASIS is to confirm that the various light beam cut-off angles are correct, and to confirm the system usability. Factors influencing usability include the range at which the system can be used, the uniformity of the light pattern, and the compatibility of the indicated approach slope with that provided by other approach aids, such as an ILS, where they are co-located.

15.2 A suggested form for recording the results of a T-VASIS flight check is included at Appendix V. When identifying individual T-VASIS boxes, the naming convention shown in MOS-139 Chapter 9, "*Figure 9.9-2: T-VASIS Layout*", is to be used.

15.3 Part of the flight check requires the accurate tracking of the flight test aircraft as it follows a particular approach path indicated by the T-VASIS system. Any appropriate method may be used to track the aircraft, and in the past theodolite tracking, laser rangefinder tracking, and precision 3-dimensional GNNS position logging have been used.

15.4 Day check:

(a) with the T-VASIS on maximum intensity stage, fly a cross-over at approximately 700 ft AGL from approximately 4 NM from the threshold, and make a qualitative check of the system to determine that there are no obvious

deficiencies such as lights not operating nor properly aligned, cut-off angles of corresponding boxes not matched, etc.;

(b) fly an approach, keeping the aircraft on the "on-slope" signal, while tracking the aircraft position, and thus determining the angle of elevation of the "on-slope" signal. Standard angle is 3.0º ± 0.05º;

(c) while the "on-slope" angle is being checked, a subjective assessment of the sensitivity of the system should be made by the pilot. A correctly adjusted system provides a fairly sensitive indication of deviations from the optimum approach slope. The sensitivity is determined by the settings of boxes 3 and 4, (and 9 and 10 if installed). If the angles at which these pairs of lights are set are divergent, the sensitivity will be "sloppy";

Note: The "on-slope" signal is the result of a delicate balance between light box intensity and the background brightness therefore on a dull day the "on-slope' signal may appear to be too tight unless the intensity is lowered to stage 5. Alternatively, intensity stage 5 will provide a signal that is too "sloppy" on a bright day.

(d) fly an approach, keeping the aircraft on the "top of the red" signal of the cross-bars, while tracking the aircraft position, and thus determining the angle of this signal. This angle should be 1.9º, must never be less than 1.9 º, but may be up to 2.0º;

(e) at approximately 1200 ft AGL, and at approximately 4 NM from the system, fly a partial orbit to check the azimuth through which the whole system can be recognized. The required minimum is 5º either side of the extended runway centre line. No adjustment is possible but the value obtained must be recorded;

(f) fly an approach to determine the cut-off angle of box 1 (and 7 if present), while tracking the aircraft position. Standard angle is 2.83º ± 0.05º;

(g) fly an approach to determine the top of the red sector of box 1 (and 7 if present), while tracking the aircraft position. This angle must be identical for boxes 1 and 7, and between 1.9º and 2.0º;

(h) fly a cross-over at approximately 700 ft AGL, and by qualitative means, determine that the cut-off angles and the top of the red sectors of box 2 and 8 (if present) are the same, and that these angles are midway between those of boxes 1 (and 7) and 3 (and 9);

(i) fly an approach to determine the cut-in angle of box 6 (and 12 if present), while tracking the aircraft position. Standard angle is 3.23º ± 0.05º;

(j) fly a cross-over at approximately 700 ft AGL, and by qualitative means, determine that the cut-in angles of box 5 and 11 (if present) are the same, and that this angle is midway between the cut-in angles of boxes 4 (and 10) and 6 (and 12);

(k) fly a straight-in approach and measure the maximum range at which the system can be recognized and flown. The minimum range is 4 NM;

(l) fly a cross-over at approximately 1200 ft AGL and check the following:

(i) that the light appears of uniform intensity throughout the system;

(ii) that the lights forming the pattern appear to be substantially in a horizontal plane;

(iii) that for the cross-bars and the "fly-up" lights, the corresponding lights on either side of the runway change simultaneously;

(iv) that the corresponding "fly-up" lights on either side of the runway disappear simultaneously;

(v) that the corresponding "fly-down" lights on either side of the runway appear simultaneously;

(m) fly a straight-in approach and call for the progressive reduction in day intensities (Stages 6, 5, and 4):

(i) check that the intensities are uniform throughout the system;

(ii) check that all lights respond correctly and simultaneously to the intensity setting changes, and that any period of light extinction between intensities is sufficiently brief as to be operationally acceptable.

15.5 Compatibility with Non-visual Aids. Where an instrument glidepath is available carry out an instrument approach maintaining the glidepath. Check that the T-VASIS indicates "on-slope" from a range of 4 NM to the threshold.

15.6 Obstacle check. From a range slightly beyond 4 NM, fly an approach sufficiently low so as to be just within the "fly-up" T indicating just red. Hold this indication throughout the approach and check that there are no obstacles throughout the azimuth spread of 5º either side of the extended centreline.

15.7 Night check. From a range of approximately 4 NM, fly an approach with both the T-VASIS and the runway lights on. Call for the progressive reduction in intensity of the night intensity stages. (Stages 3 to 1 for a 6-stage installation, or Night intensity for a 3-stage installation.) Check that:

(a) intensity matching of the bar to bar and bars to legs are uniform throughout the system, for each intensity stage;

(b) the intensity of the T-VASIS is visually compatible with the runway edge lights and the threshold lights for each intensity stage; and

(c) all T-VASIS lights respond correctly and simultaneously to the intensity setting changes.

16. FLIGHT CHECK – PILOT ACTIVATED LIGHTS (PAL)

16.1 The flight check is to confirm the operation of the PAL, and also its usability. Factors influencing usability include the ease with which a pilot can enter the activation code; the range at which the system can be used, both on the aerodrome and in flight approaching the aerodrome; and the conspicuity of the ten-minute turn-off light.

16.2 A suggested form for recording the results of a PAL flight check is included as Appendix VI.

16.3 On the ground. Conduct the following checks:

(a) ascertain that all the lighting facilities are activated by the PAL system;

(b) check the location and means of access to the manual ON/OFF switch activate the lights using the manual switch;

(c) activate the lights from the apron;

(d) activate the lights from the runway holding position or threshold of each runway;

(e) check that the ten-minute turn-off warning lights are clearly visible from each of the above locations;

(f) check that the illumination period meets the specified time for the particular aerodrome;

(g) check that when the ten-minute turn-off warning lights are flashing, that transmitting the turn-on code reactivates the aerodrome lighting for another full illumination cycle;

(h) where the PAL activates a multi stage intensity facility, have the local electrician simulate the transition from day to twilight to night, by controlling the amount of light reaching the light sensitive switch. Check that the various aerodrome lighting systems respond correctly to these changes;

(i) if the aerodrome has a control tower, certified air/ground radio operator (CA/GRO), or similar, with remote control of the aerodrome lighting systems, confirm that the control circuitry is such that when the controller is on duty the PAL control is overridden by the Controller's control.

16.4 In the air. Conduct the following checks:

(a) activate the lights from within the circuit area;

(b) activate the lights from 15 NM from the aerodrome at the lowest safe altitude (LSALT) on the route with the lowest LSALT, or the main routes to the aerodrome;

(c) check that the ten-minute turn-off warning lights are clearly visible in the circuit area and on final approach to each electrically lit runway;

(d) where the PAL activates a multi stage intensity facility, check that the various aerodrome lighting systems respond correctly to the changes in background luminance. Check that at night, the intensity of the visual approach slope guidance system is visually compatible with the runway edge lights and the threshold lights.

16.5 Weak transmitter simulation. To simulate an aircraft with a weak transmitter, the following checks are suggested. A hand-held transceiver may be used for each of the on-aerodrome checks, and the in-the-air check (b) can be carried out from a distance of 30 NM at the lowest safe altitude plus 1500ft.

Bill McIntyre
Executive Manager
Aviation Safety Standards

Appendix I

GROUND CHECK REPORT - PAPI

Aerodrome	
Runway	
Design Aircraft	
Eye-to-wheel-height group	
Design wheel clearance over threshold	
Design approach angle	
Design minimum eye height over threshold	
Critical Obstacle, if any; (location and height)	
PAPI Manufacturer Type	
Single or Double Sided	
ILS co-sited (Yes/No)	
Any non-standard design aspects, such as reduced azimuth. (Give details)	

	Left Side Light Units A-B-C-D	**Right Side** (if installed) Light Units E-F-G-H
Distance from Threshold - Design		
- Measured		
Distance - R/W edge to D		
Distance - D to C		
Distance - C to B		
Distance - B to A		
Distance - R/W edge to E		
Distance - E to F		
Distance - F to G		
Distance - G to H		
Aligned along front of Units (yes/no)		
Aligned in horizontal plane (yes/no)		
Leveling (clinometer setting) of - A		
Leveling (clinometer setting) of - B		
Leveling (clinometer setting) of - C		
Leveling (clinometer setting) of - D		
Leveling (clinometer setting) of - E		
Leveling (clinometer setting) of - F		
Leveling (clinometer setting) of - G		
Leveling (clinometer setting) of - H		
Foundations, assessed as stable (yes/no)		
Vertical colour transition angle of - A		

	Left Side Light Units A-B-C-D	**Right Side** (if installed) Light Units E-F-G-H
Vertical colour transition angle of - B		
Vertical colour transition angle of - C		
Vertical colour transition angle of - D		
Vertical colour transition angle of - E		
Vertical colour transition angle of - F		
Vertical colour transition angle of - G		
Vertical colour transition angle of - H		
Light beam horizontal spread - A		
Light beam horizontal spread - B		
Light beam horizontal spread - C		
Light beam horizontal spread - D		
Light beam horizontal spread - E		
Light beam horizontal spread - F		
Light beam horizontal spread - G		
Light beam horizontal spread - H		
Obstacle Assesment Surface, vertical angle, and any penetrations		
Critical Obstacle, if any. Angle to top.		

Overall System Check, and General Remarks:-

Add additional pages if necessary)

I certify that I have checked this PAPI installation, and the system meets the relevant Specifications and Standards.

Signature _____ Date _____

Name (print) _____

Qualification _____

Appendix II

GROUND CHECK REPORT - T-VASIS

Aerodrome	
Runway	
Design eye-height over threshold	
Design approach angle	
AT-VASIS or T-VASIS	
ILS co-sited (Yes/No)	
Critical Obstacle; (location and height)	
Any design variations from standard layout. (Give details)	

Ground Check Report

(Details of all checks made, and any necessary corrective actions as a result of the checks, are listed below).

(Add additional pages if necessary)

I certify that I have checked this T-VASIS installation, and the system meets the relevant specifications and standards.

Signature _____ Date _____

Name (print) _____

Qualification _____

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix III

FLIGHT CHECK REPORT - AERODROME LIGHTING SYSTEMS

Aerodrome		Weather	
Runway		Visibility	
Aircraft		Cloud	
Date		Time	
Crew			

Not all systems listed on this form will necessarily require checking at a particular aerodrome.

LIGHTING SYSTEM (where provided)	**FINDINGS** satisfactory / unsatisfactory	**REMARKS**
Runway Lights		
- Edge		
Pattern		
Colour		
Intensity		
- Threshold Including **RTIL** and **Wing Bars**, where provided .		
Pattern		
Colour		
Intensity		
- Runway End		
Pattern		
Colour		
Intensity		
Visual circling		
Intensity:-		
No of Stages		
Intensity changes		
Line of Sight		
Taxiway Lights - Edge		
Adequate guidance		
Colour		
Taxiway Lights – C/L		
Adequate guidance		
Colour		
Taxiway – Turn Node		
Adequate guidance		
Colour		

LIGHTING SYSTEM (where provided)	**FINDINGS** satisfactory / unsatisfactory	**REMARKS**
Runway Guard Lights, Intermediate Holding Position Lights, Stop Bars		
Clearly visible		
Location & Pattern		
Colour		
Intensity		
Movement Area Guidance Signs		
Visible		
Legible		
Colour		
Illuminated Wind Direction Indicator		
Conspicuous - Approach		
Conspicuous – Cct area		
Conspicuous - Apron		
Conspicuous - Thresholds		
Truly representative		
No glare		
Apron Floodlights		
Adequate Illumination		
No glare		
Aerodrome Environment		
Obstacle lights		
Extraneous light		
Aerodrome Beacon:-	Present / Not present	
Visual characteristic		
Approx. visual range		
Approach Lights CAT I or CAT II/III (circle the appropriate one)		
Pattern		
Colour		
Intensity:-		
No of Stages		
Intensity changes		
Compatibility with Runway lights		
Runway Centreline Lights		
Pattern		
Colour		

LIGHTING SYSTEM (where provided)	**FINDINGS** satisfactory / unsatisfactory	**REMARKS**
Intensity:-		
No of Stages		
Intensity changes		
Compatibility with other light systems		
Runway Touchdown Zone Lights		
Pattern		
Intensity:-		
No of Stages		
Intensity changes		
Compatibility with other light systems		

Remarks:-

(Add additional pages if necessary)

I certify that I have flight checked the aerodrome lighting system/s, and the system/s meets the relevant operational requirements.

Signature _____ Date _____

Name (print) _____

Letter of Competency No. _____

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix IV

FLIGHT CHECK REPORT - PAPI

Aerodrome	
Runway	
Design approach angle	
Single or Double Sided	
ILS co-sited (Yes/No)	
Any design variations from standard layout. (Give details)	

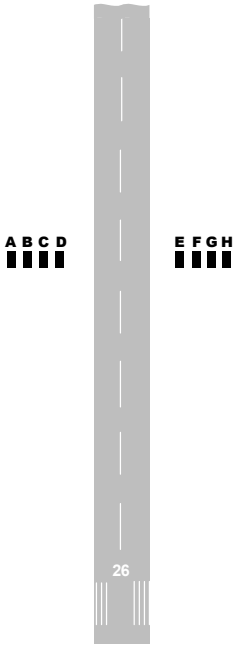
Weather		Visibility	
Cloud		Aircraft	
Date		Time	
Crew			

ITEM CHECKED		FINDINGS
DAY CHECK		
Qualitative check of System	Satisfactory	
- Uniformity of intensity	Satisfactory	
- Straight, Horizontal appearance	Satisfactory	
- Colour change sharpness	Satisfactory	
- Steady progression of signal	Satisfactory	
- Double sided – Symmetry (L-R)	Satisfactory	
Day Intensities		
– Response to Change of Intensity	Satisfactory	
Range of System	4 NM min	
Sensitivity of "on-slope" signal.	Satisfactory	
Compatibility with ILS (where present)	Satisfactory	
Obstacle clearance on Approach, with full system just Red, throughout the azimuth of light beams either side of centreline	Satisfactory	
Azimuth restrictions (if applicable)	Confirm effectiveness	
NIGHT CHECK		
Night Intensities		
– Matching of PAPI to Runway (for each Night Intensity)	Satisfactory	
– Response to Change of Intensity	Satisfactory	

Subjective assessment of aiming point (and relation to touchdown zone marking)

Remarks:-

(Add additional pages if necessary)



I certify that I have flight checked this PAPI installation, and the system meets the relevant operational requirements.

Signature _____ Date _____

Name (print) _____

Letter of Competency No. _____

Appendix V

FLIGHT CHECK REPORT - T-VASIS

Aerodrome	
Runway	
Design approach angle	
AT-VASIS or T-VASIS	
ILS co-sited (Yes/No)	
Any design variations from standard layout. (Give details)	

Weather		Visibility	
Cloud		Aircraft	
Date		Time	
Crew			

DAY CHECK

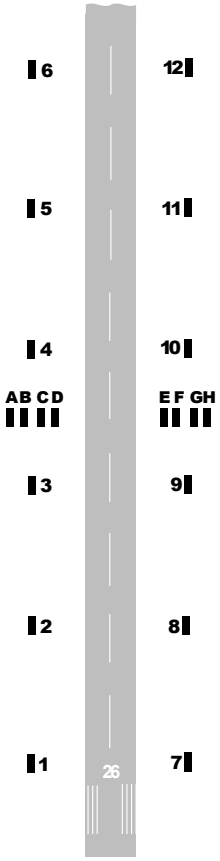
ITEM CHECKED		FINDINGS
Qualitative check of System	Satisfactory	
"On-slope" angle	2.95 – 3.05	
Sensitivity of "on-slope" signal.	Satisfactory	
Top of Red Sector on Cross-bars	1.9 – 2.0	
Day Azimuth (about centerline)	5.0 min	
Cut-Off angle – Box 1 (and 7)	2.78 – 2.88	
Top of Red Sector – Box 1 (and 7)	1.9 – 2.0	
Cut-off angle – Box 2 (and 8)	Satisfactory	
Top of Red Sector – Box 2 (and 8)	Satisfactory	
Cut-In angle – Box 6 (and 12)	3.18 – 3.28	
Cut-In angle – Box 5 (and 11)	Satisfactory	
Range of System	4 NM min	
System Uniformity	Satisfactory	
Day Intensities		
– Matching of Bar to Bar	Satisfactory	
– Matching of Bar to Legs	Satisfactory	
– Response to Change of Intensity	Satisfactory	
Compatibility with ILS (where present)	Satisfactory	
Obstacle clearance on Approach with T just Red through 5º either side of centreline	Satisfactory	

NIGHT CHECK

ITEM CHECKED		FINDINGS
Night Intensities		
– Matching of Bar to Bar	Satisfactory	
– Matching of Bar to Legs	Satisfactory	
– Matching of T to Runway (for each Night Intensity)	Satisfactory	
– Response to Change of Intensity	Satisfactory	

Remarks:-

(Add additional pages if necessary)



I certify that I have flight checked this T-VASIS installation, and the system meets the relevant operational requirements.

Signature _____ Date _____

Name (print) _____

Letter of Competency No. _____

Appendix VI

FLIGHT CHECK REPORT - PILOT ACTIVATED LIGHTS

Aerodrome		Weather	
Runway/s		Visibility	
Aircraft		Cloud	
Date		Time	
Crew			

The following aerodrome lighting systems are controlled by the PAL:-

ITEM CHECKED	FINDINGS	REMARKS
	satisfactory / unsatisfactory	
Checks on the Ground		
Manual switch		
Activate from Apron		
Activate from Thresholds		
Vis. of turn-off lights		
Period lights are ON	minutes	
Re-activation during last ten-minute warning		
Automatic intensity change		
Control Tower interface		
Checks in the Air		
Activate from Cct Area		
Activate from 15 NM		
Vis. of turn-off lights		
Intensity:-		
Correct control of Various lighting		
Intensity changes		
Compatibility with Runway Lights		

I certify that I have flight checked this PAL system, and the system meets the relevant operational requirements.

Signature _____ Date _____

Name (print) _____

Letter of Competency No. _____