Advisory Circular

GUIDANCE ON THE MAINTENANCE OF VISUAL AIDS AT AERODROME

AC AGA–MOVA–01–2024

(First Issue)

Aerodrome & Air Navigation Safety Oversight Office (AANSOO)
Office of the Director General
Civil Aviation Authority of the Philippines
Old MIA Road, Pasay City, 1300

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

CAAP will generally accept that when the provisions of an Advisory Circular have been met, compliance with the relevant regulatory obligations has been satisfied.

Where an AC is referred to in a "Note" within regulatory documentation, the AC remains as a guidance material.

ACs should always be read in conjunction with the referenced regulations.

I. PURPOSE

This Advisory Circular (AC AGA-MOVA-01-2024) is issued to provide supplementary guidance to aerodrome operators on the maintenance of visual aids at an aerodrome. It provides guidance on what is acceptable to Aerodrome and Air Navigation Safety Oversight (AANSOO) of Civil Aviation Authority of Philippines (CAAP) and to demonstrate compliance in Section 9.1.15 - Maintenance performance of aerodrome lighting (Visual aids) of the Manual of Aerodrome Standards for Aerodromes (MOS-Aerodromes).

II. APPLICATION

AC AGA-MOVA-01-2024 is applicable to all airport operators in the Philippines.

III. RELATED RULES

This AC relates specifically to the requirements of MOS-Aerodromes under Chapter 9 Section 9.1.15 - Maintenance performance of aerodrome lighting (Visual aids).

V. ACKNOWLEDGEMENT

Aerodrome and Air Navigation Safety Oversight Office (AANSOO) of the Civil Aviation Authority of the Philippines (CAAP) acknowledges the valuable information provided by ICAO through its published Documents and other related guidance materials and best practices developed by international organizations.

VI. COPIES OF THIS AC

AC AGA-MOVA-01-2024 is available and can be downloaded at the official website of CAAP at www.caap.gov.ph. A printed copy of this AC can be requested from the Regulatory Safety Standards Division (RSSD) of the Aerodrome and Air Navigation Safety Oversight Office (AANSOO), Civil Aviation Authority of the Philippines, located at MIA Road corner, Ninoy Aquino Avenue, Pasay City, Metro Manila, 1300 with Tel. No.: (02) 8246 4988 local 2040.

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FOREWORD

Pursuant to the overarching mandate to uphold safety, regularity and efficiency within the realm of aviation operations and in adherence to the regulatory edicts as prescribed by the Civil Aviation Authority of the Philippines (CAAP) and of the International Civil Aviation Organization (ICAO), this Advisory Circular (hereinafter referred to as the "AC AGA-MOVA-01-2024") is hereby promulgated. This AC is imbued with the objective of providing Aerodrome Operators with comprehensive guidance on the Maintenance of Visual Aids at aerodromes.

Although this AC provides the minimum requirements for establishing a maintenance program, due to the varying complexities of individual airports and the visual aids provided, the program must be tailored to suit each airport's particular needs. Aerodrome operators may use this AC relative to the information available in manufacturer's instruction books, equipment manuals, handbooks and other ACs.

The purpose of airport visual aids is to assist in the safe and efficient movement of aircraft during landing, takeoff and taxiing maneuvers. It is essential that a high degree of operating reliability be maintained. To achieve this, an effective preventative maintenance program must be established and maintained.

This AC provides recommendation about establishing a program but, due to the varying complexities of airports and the visual aids facilities provided, the program must be tailored to suit each airport's particular needs. Maintenance procedures (corrective and preventive) for specific equipment are usually covered in the instruction manuals supplied with the equipment.

Maintenance of Visual Aids to the highest degree of standards are required to ensure reliability and integrity of visual aids system to aid in the safe operation of aircraft.

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DEFINITIONS

Aerodrome. A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.

Aerodrome beacon. Aeronautical beacon used to indicate the location of an aerodrome from the air.

Aeronautical ground light. Any light specially provided as an aid to air navigation, other than a light displayed on an aircraft.

Approach lighting systems. A light system consists simple and precision approach lighting systems.

Barrette. Three or more aeronautical ground lights closely spaced in a transverse line so that from a distance they appear as a short bar of light.

Fixed light. A light having constant luminous intensity when observed from a fixed point.

Light failure. A light shall be deemed to be unserviceable when the main beam average intensity is less than 50% of the value specified in the appropriate figure showing the isocandela diagram. For light units where the designed main beam average intensity is above the value shown in the isocandela diagram, the 50% value shall be related to that design value. (When assessing the main beam, specified angles of beam elevation, toe-in and beam spread shall be taken into consideration).

Lighting system reliability. The probability that the complete installation operates within the specified tolerances and that the system is operationally usable.

Maintenance program. A program that includes all preventive and corrective measures to maintain design functions of structures, systems, and components at an acceptable level.

Maneuvering area. That part of the aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons.

Marking. A symbol or group of symbols displayed on the surface of the movement area in order to convey aeronautical information.

Precision Approach Path Indicator (PAPI). A light system consists of a wing bar of four sharp transition multi-lamp (or paired single lamp) units equally spaced. The system shall be located on the left side of the runway unless it is physically *impracticable to do so.*

Runway guard light. A light system intended to caution pilots or vehicle drivers that they are about to enter an active runway.

Runway edge lights. A light system provided for a runway intended for use at night or for a precision approach runway intended for use by day or night.

Runway threshold and wing bar lights. Fixed unidirectional lights showing green in the direction of approach to the runway. The intensity and beam spread of the lights shall be adequate for the conditions of visibility and ambient light in which use of the runway is intended.

ACRONYMS AND ABBREVIATIONS

AANSOO	Aerodrome and Air Navigation Safety Oversight Office
AC	Advisory Circular
AGA	Aerodrome Ground Aids
CAAP	Civil Aviation Authority of the Philippines
ICAO	International Civil Aviation Organization
MOVA	Maintenance of Visual Aids
PMI	Preventive Maintenance Inspection
PMP	Preventive Maintenance Program
RSSD	Regulatory Safety Standards Division

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REFERENCES

The regulatory framework underpinning this Advisory Circular is based on the following documents:

1. Civil Aviation Regulations for Aerodromes
2. Manual of Standards for Aerodromes
3. ICAO Annex 14, Volume I Aerodrome Design and Operation
4. ICAO Document 9137 - Aerodrome Design Manual Part 9 – Airport Maintenance Practices
5. ICAO Document 9774 - Manual of Certification of Aerodromes
6. ICAO Document 9981- PANS Aerodromes

Furthermore, it is imperative to underscore that this advisory circular is not to be construed as a substitute for, nor does it supersede any existing laws, regulations, or mandates. Rather, it should be interpreted as a supplementary instrument designed to enhance the understanding and implementation of the aforesaid statutory requirements.

Lastly, AC AGA-MOVA-01-2024 is dynamic in nature, reflective of the fluidity of the aviation domain. It is subject to periodic revisions and updates, which will be duly effected to encapsulate advancements in the aviation industry, shifts in operational paradigms, and the evolution of regulatory landscapes.

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MAINTENANCE OF VISUAL AIDS AT AERODROMES

CHAPTER 1. REQUIREMENT FOR VISUAL AIDS

1.1 CAR – Aerodromes 2.2.245 requires aerodrome operators to have a preventive maintenance system for visual aids to ensure reliability of all lights, lighting systems and markings in accordance with the specifications in the Manual of Standards for Aerodromes.

1.2 MOS-Aerodromes 9.1.15.2, states that a system of preventive maintenance of visual aids shall be employed at an aerodrome to ensure lighting and marking system reliability.

1.3 Numerous visual aids are available to provide information and guidance to pilots maneuvering on the aerodrome. These aids may consist of single unit or complex systems composed of many parts. Often visual aids have different performance requirements and configurations but may share common installation procedures. The basic purpose of visual aid systems is to aid in the safe operation of aircraft. Therefore, the highest standards of maintenance are required.

1.4 Corrective and preventive maintenance procedures for specific equipment are usually covered in instruction manuals supplied with the equipment. However, it is essential to establish a comprehensive routine maintenance system for servicing lights and other equipment's so that the installation complies with the specified requirements.

CHAPTER 2. PERSONNEL

2.1 The task of maintaining visual aids at an aerodrome should be entrusted only to reliable and skilled personnel who have proper training and experience. These individuals should be present or be on call during the operating hours of the aerodrome to correct any deficiencies that might develop.

2.2 Training program should be established to maintain the competency of maintenance personnel and to keep them abreast of new developments.

CHAPTER 3. SAFETY PRACTICES

3.1 When performing maintenance on aerodrome visual aids, it is highly recommended the use of the following safety practices:

a. Ensure that all maintenance workers are trained and familiar with electrical safety.

b. Strictly observe all safety rules.

c. Ensure that the test equipment is properly rated for the voltage under test or for the intended application.

d. Prior to beginning any maintenance work on aerodrome lighting circuits, coordinate the work schedule with the air traffic management, facility manager or airport operations personnel. Make sure circuits will not be energized during maintenance by observing strict lock-out tag-out procedures for the equipment and obtain authorization for local control if equipment is normally operated via remote control.

e. Where maintenance is to be conducted on a high-voltage circuit, assign at least two electricians, with at least one having a thorough knowledge of the layout of all aerodrome high-voltage circuits.

f. Performing maintenance on many aerodrome visual aids requires workers to traverse the active airfield, all workers must be fully knowledgeable of air traffic control and radio communication procedures. Workers must also be familiar with aerodrome runway and taxiway layout to avoid the possibility of runway incursions. All air traffic control instructions must be read back to the controller and, if the worker has any question regarding the instructions of the controller, the worker must ask the controller to repeat the message. All vehicles operated within the airside must be properly marked and lighted.

CHAPTER 4. AS-BUILT DRAWINGS

4.1 A set of as-built drawings should be kept available. These drawings must be kept up to date and any changes at site should be reflected immediately on these drawings.

4.2 The completeness and accuracy of all circuit diagrams, drawings and descriptions should be checked as and when necessary or at least annually.

CHAPTER 5. TOOLS AND TEST EQUIPMENT

5.1 Tools and equipments used for visual aids maintenance and measurement should be listed and properly calibrated as per manufacturers requirements and recalibrated or replaced before expiry.

5.2 Records of these tools and test equipment including calibration and recalibration should be maintained.

CHAPTER 6. SPARE PARTS

6.1 An adequate stock of spare parts should be available at the aerodrome. The level of stock will vary depending on the time required to re-supply a particular item and its shelf life. While stocking, replacements for 10-15 % of the respective AGL may be considered as a normal practice.

CHAPTER 7. MAINTENANCE MANAGEMENT

7.1 The purpose of the maintenance management system is to ensure the maximum availability at any given system of a minimum cost in man-hours or funds. Aerodrome with heavy traffic may require more frequent maintenance servicing than those used only by light traffic.

7.2 The maintenance schedule includes maintenance planning, preventive maintenance inspection, visual inspection, repair, installation, calibration, and unscheduled maintenance procedures. Regardless of the actual maintenance routines decided upon, the following elements are essential to any controlled maintenance program:

a) Document the service checks that comprise the maintenance program.
b) Record the performance of each maintenance actions scheduled or unscheduled.
c) Document repairs and troubleshooting performed on each piece of equipment and the results of those actions as well as the symptoms related to the malfunction. This allows for more rapid troubleshooting of similar problems at a later stage.

Note: The maintenance procedures documented in this AC may be considered as a minimum guideline.

CHAPTER 8. MAINTENANCE SCHEDULE

8.1 Documenting the maintenance schedule by spelling out each item of routine maintenance is beneficial in several ways:

a) It allows planned allocation of man-hours to the maintenance function.
b) It helps to establish spare part stock levels.
c) It identifies the necessary maintenance routines to new employees, decreasing training time needed for system familiarization.
d) It identifies the scope of the maintenance task in terms of man-hours and material requirements.

CHAPTER 9. MAINTENANCE RECORDS

9.1 Maintenance records are an important part of an effective maintenance management system;

- ✓ they provide a service history of each piece of equipment,
- ✓ ensure regular maintenance without duplication of effort, and
- ✓ provide a data base for statistical analysis of system performance.

9.2 Knowledge gained from regular inspections will not be retained, and preventive maintenance will be difficult without records. An effective records system should allow for the recording and retrieval of information with a minimum of effort.

9.3 The records system should compile data that will document the effectiveness of the maintenance program. By checking the records, a manager should be able to determine whether a particular maintenance task is being done frequently or not.

CHAPTER 10. PREVENTIVE MAINTENANCE PROGRAM

10.1 Reliable functioning of aerodrome visual aids is essential to safety, capacity, and operation especially for low visibility operations. Therefore, it is essential that a preventive maintenance program should be established to ensure reliable service and proper equipment operation.

10.2 Properly scheduled inspections, testing, and calibrations are essential to the functioning of these systems. Aerodrome lighted visual aid maintenance should receive high priority to prevent equipment failure, false signals, and deterioration of the system.

10.3 Preventive maintenance inspection (PMI) schedule in a preventive maintenance program is an effective for each equipment and visual aid. This schedule should also include all cable systems. The PMI schedule is the foundation for the successful maintenance of the equipment. If the PMI is performed properly and at the scheduled time, it will ensure system performance and minimize unscheduled interruptions and breakdowns. The PMI schedules, based upon recommendations from the manufacturers and users of the equipment, be considered to keep the equipment in good condition. Adjust the frequency of a particular PMI after experience is gained under local operating conditions.

CHAPTER 11. LIGHT MAINTENANCE SCHEDULE

11.1 During servicing of lights, the recommendations of the equipment manufacturer should be followed to ensure the required service standard. Service records showing maintenance schedules recommended by the manufacturer should be prepared for each piece of equipment. These can be arranged in a reminder file to make sure all equipment are serviced regularly. This record should have space to enter observations, measurements and initials of the servicing individual. If local conditions indicate a change in time interval of servicing then the schedule can be altered in consultation with the equipment manufacturer.

11.2 The frequency at which routine inspection, cleaning and servicing are to be performed will vary according to the type of equipment, its location and usage. A maintenance programme must be drawn up for each individual facilities based on past experience and its aim should be to achieve the required service standard. The schedules are presented as guidance in establishing a preventive maintenance programme. More frequent checks may be necessary for the lights serving precision approach category runways. The time schedules shown should not take precedence over manufacturers' instructions or be applied to similar equipment. Each check should be followed by appropriate corrective action.

11.3 Maintenance for all types of approach, runway and taxiway lights should include checking and, if necessary, taking the indicated corrective action, as follows:

A. *Daily*

- ✓ System for burnt-out lamps; replacing burnt-out lamps
- ✓ System for gross misalignment (if applicable); adjusting
- ✓ Control equipment for proper operation on each brightness step (if applicable); correcting or repairing malfunctions
- ✓ Glass for breakage; replacing broken parts

B. *Annually*

- ✓ Fasteners of each light unit; tightening
- ✓ Lights for corrosion; painting or replacing rusted parts
- ✓ Reflector of each light unit (if applicable); cleaning or replacing
- ✓ Glass of each light; cleaning or replacing
- ✓ Lamps of the whole system; replacing of the unserviceable lamps or entire system

- ✓ Elevation setting (if applicable); adjusting
- ✓ Horizontal alignment; adjusting
- ✓ Plug connections for cleanness and faultless contact; cleaning or replacing of dirty parts
- ✓ Light fittings and their supporting structure (if existing) for adequacy of fastening and for corrosion and rust; tightening fasteners; painting or spraying
- ✓ General condition of the whole system, and recording result

C. *Unscheduled*

- ✓ Elevation setting and the horizontal alignment (if applicable) of the light unit after severe storms and snowfalls; adjusting
- ✓ Light unit's tor obstruction by grass or mow. etc. (not applicable for Inset Lights); removing any obstacles found.

11.4 In addition to the maintenance programme specified in 11.3, the following should be carried out for visual approach slope indicators, runway threshold and end light, and inset lights.

11.4.1 Visual approach slope indicator maintenance should include checking and, if necessary, taking the indicated corrective action, as follows:

A. *Twice monthly*

- ✓ Elevation setting (vertical angle) of the light units; adjusting
- ✓ Spreader glasses, filters and lamps for cleanness; cleaning

B. *Annually*

- ✓ System from the air, and recording results; adjusting and replacing lamps
- ✓ Supporting structure and the foundation of each unit; repairing

11.4.2 Runway threshold and runway end light maintenance should include checking and, if necessary, taking the indicated corrective action as follows:

A. *Twice weekly*

- ✓ Fasteners of the lights; tightening
- ✓ Glass of each light for wear and tear; replacing.

11.4.3 Inset lights (runway centre line lights, touchdown zone lights, taxiway centre line lights, stop bar lights) maintenance should include checking and, if necessary, taking the indicated corrective action, as follows:

A. *Daily*

- ✓ lenses for cleanness; cleaning

B. *Twice weekly* (not applicable to taxiway and stop bar lights)

- ✓ Light output of lights within 900 m from each threshold including measuring and recording the results; cleaning of the lenses.
- ✓ Top parts of lights within 900 m from each threshold; replacing

C. *Quarterly* (not applicable to taxiway and stop bar lights)

- ✓ Light output of all lights within the system including measuring and recording the results; cleaning of the lenses.
- ✓ Top parts of the lights; replacing.

D. *Semi-annually* (not applicable to taxiway and stop bar lights)

- ✓ Lights for cleanness inside and out; cleaning
- ✓ Lights for moisture; drying
- ✓ Electrical connections of the lights; tightening; spraying with contact agent
- ✓ Alignment of light; adjusting

E. *Annually*

- ✓ Prism and filter; cleaning or replacing
- ✓ Sealing compound; rescaling

F. *Unscheduled*

- ✓ Top parts of the lights two to four weeks after replacement; tightening.

11.5 Other airport lights include, for example, airport beacons, obstacle lights and wind direction indicators normally need less maintenance than approach, runway or taxiway lighting systems. Their maintenance should include checking and, if necessary, taking the indicated corrective action as follows:

A. *Daily*

- ✓ Lamps; replacing if necessary
- ✓ Control equipment for proper operation (not applicable in the case of obstacle lights); correcting or repairing
- ✓ Fabric of the wind cone; repairing or replacing.

B. *Semi-annually* (only for airport beacon)

- ✓ Power supply (brushes and slip-rings); cleaning or replacing
- ✓ Electrical connections; tightening
- ✓ Rotating parts; fastening.

C. *Annually*

- ✓ Optical system of the airport beacon
- ✓ Glasses and the gaskets of obstacle lights; cleaning or replacing

- ✓ Function of the flashing relays and of the twilight switches of the obstacle lights; cleaning, repairing or replacing
- ✓ Power supply and the lighting of the wind direction indicator; repairing or replacing
- ✓ Electrical connection; tightening; spraying with contact agent
- ✓ Fasteners of obstacle lights
- ✓ Structure and the fasteners of the wind direction indicator; tightening or repairing the structure
- ✓ Lights for corrosion; painting
- ✓ Colour of the fabric cone of the wind direction indicator; replacing.
- ✓ Location of obstacle lights for easy access for maintenance; arranging of change of location if required and possible.

D. *Unscheduled*

- ✓ Wind direction indicator after severe storms; repairing.

CHAPTER 12. DOCKING GUIDANCE SYSTEM

12.1 Maintenance programmes for various types of aircraft docking guidance systems are provided at aerodromes and it is very difficult to describe a generally applicable maintenance programme for these very different systems. Principal requirements to be checked and maintenance action to be taken, if necessary, include:

A. *Daily*

- ✓ System for over-all operation; repairing
- ✓ Lamps; replacing burnt-out lamps.

B. *Semi-annually*

- ✓ Alignment of the system; adjusting.

C. *Annually*

- ✓ Electrical connections (if provided) for corrosion, wear and tear; cleaning, tightening and replacing.
- ✓ Function of relays (if provided); cleaning or replacing
- ✓ Structure of the system and the function of all mechanical parts; repairing
- ✓ System for cleanness and moisture; cleaning and drying.

CHAPTER 13. LIGHT MAINTENANCE PROCEDURES

13.1 For reasons of efficiency, the maintenance of lights should, as far as practicable, be carried out indoors. Inconveniences of working out of doors, such as heat, cold, precipitation and aircraft noise can be avoided and traffic restrictions or interruptions will be reduced to minimum. The quality of service will also be higher in workshops than out door. This is particularly applicable when, in the interest of unrestricted traffic flow during day hours, the work has to be carried out during the night.

13.2 The maintenance procedure commonly used comprises two steps:

- ✓ Removal of defective lights and immediate replacement by new or repaired ones.
- ✓ Removal of defective lights and immediate replacement by new or repaired ones.

13.3 Provision of a sufficient number of stored spare lights is a prerequisite. The number of spare parts depends on the over-all requirement of the aerodrome and the experience with the sensitivity to damage of the various types of lights on the aerodrome. It is useful to select lights which are designed to permit removal and installation within a short time, without the use of very sophisticated technical equipment. Furthermore, all mechanical and optical parts of the light should be incorporated in the removable part.

CHAPTER 14. CLEANING PROCEDURES FOR LIGHTS

14.1 The type and degree of contamination of the various lights on an aerodrome will be different. While elevated approach and edge lights are normally contaminated by weather (dust carried by wind and rain), more severe contamination can be observed on inset lights, particularly on runways. Rubber deposits from tires on touchdown and exhaust from engine reverse thrust procedures results in firmly sticking deposit on the exterior glassware of lights. The very different degree of contamination must be reflected in the maintenance schedule of different categories of lights or sections in the runway/taxiway system.

14.2 While cleaning the glassware of lights, the manufacturer's recommendations should be observed. Normally, cleaning is accomplished by washing the glassware with a cleansing mixture of water and a special solvent that will neither affect the sealing material nor produce a residual film on the glass. The solvent must be given sufficient time to dissolve the deposits. If necessary, rubber spots may be scraped off by using plastic tools or powder before using the solvent. Other mechanical aids for cleaning may be sponge, cloths, hand brushes or electric rotating brushes. The cleaning technique and the materials used should not scratch or groove the glass surface nor damage the sealing material.

14.3 Dry cleaning of glassware should be avoided however, if clearing becomes necessary for some reason, no sand or other abrasive material should be used. In such cases cleaning can be done by using clean ground-up walnut or pecan shells and dry compressed air. Special treatment can normally be avoided by following a maintenance schedule with wet cleaning at suitable intervals.

14.4 For cleaning light fittings on site special maintenance vehicle equipped with air compressors, vacuum cleaner and solvent tanks should be used. A low working seat at the rear or front, or an opening in the bottom of the maintenance vehicle facilitates the work considerably. In some cases, these vehicle can carry the required tools for all types of maintenance work, including the removal of old lights and the installation of new ones.

14.5 Thorough cleaning of the interior of the light to remove mud, moisture or rust should be carried out in workshop. Only minor contaminants, such as dust, should be removed on site.

CHAPTER 15. LIGHT MEASUREMENT

15.1 The light output will diminish with the lapse of time due to lamp aging. Contamination of reflector and lens will result in a further degradation of light output. According to MOS 9.1.15.1, a light is considered to have failed when its output is less than 50 per cent of the required intensity. For practical reasons replacement of a light is recommended when its output falls below 70 per cent of that specified for a new light.

15.2 Light measurements should be carried out regularly to detect early light output reduction. Appropriate equipment for both field and bench measurement of light output is available. The equipment produced by light manufacturers does not, however, indicate the absolute intensity values but provide ratios between measured and original light intensities of each individual type.

15.3 Field measurements are particularly necessary for inset lights. Wheel loads on inset lights may frequently cause damage. One type of measuring equipment offered by the light manufacturers for field use consists of a photocell and a micro ammeter. Such measuring devices are placed over the light fitting and the meter reading observed is compared with the calibration value. Before measuring, the lights should be cleaned and switched to the highest available intensity setting.

15.4 Light measurements can also be made by using a photographic 1° spot meter, which is not placed on the Light casing directly, but moved vertically and horizontally through the light beam at a fixed distance. The intensity is checked by comparison with the results of a calibration test with a new light.

15.5 The measuring procedures described above are quite time-consuming. With the special device for each measurement, it will take about 2 minutes. Often a much faster visual observation carried out by experienced personnel will achieve comparable results for discovering and reporting single lights with unacceptable light output. For visual checks the level of brightness must be switched to "low" (3 to 10 percent of maximum).

15.6 For adjustment of the correct angle of the beam, lights are normally furnished with alignment markings. Furthermore, light manufacturers offer suitable adjustment equipment for their product. Beam misalignment caused by displacement of the optical system inside, however, cannot be corrected by adjusting the casing. When such misalignment is observed visually, the light should he adjusted in the workshop.

15.7 For measuring light output in the workshop the measuring equipment produced by the light manufacturer concerned should be used. The equipment consists of a bench to fix the light and a photocell sensor element. Micro ammeter readings should be compared with the calibration value. Directional adjustments can be made using the alignment screws.

CHAPTER 16. LAMP REPLACEMENT

16.1 The life span of lamps varies from 100 to some 1000 hours of operation. The life time depends on the percentage of operation at high brightness levels and on the number of switching. Also, dynamic stresses imposed by aircraft wheel loads (inset lights) and temperature-induced stresses inside the casing affect the lamp life. Lamps which have failed should be replaced as soon as possible since the lighting system of an aerodrome has to meet specified serviceability requirements stipulated in MOS 9.1.15.2.

16.2 Lamp replacement can be organized in two different ways:

- ✓ Only those lamps which have failed or lamps showing major output reduction are replaced upon checking; this method requires checks to be carried out at short intervals;
- ✓ Bulk changing of lamps in certain sections of the entire lighting system, in accordance with a fixed time schedule. The intervals between replacements have to be derived from local experience with the average life of lamps in use. Lamps should be changed when they have been operated for 80 per cent of their average life. For this maintenance method a reliable record of operating

hours for the individual sections of the airport's lighting system is a prerequisite. This method requires less frequent checks.

16.3 Lamp replacement in the workshop is preferable, particularly with inset lights. The unserviceable light should be removed from its position and replaced by a serviceable light. Lamp replacement of elevated lights may be carried out on site provided that the casing can be opened easily and quickly, and the socket of the lamp needs no realignment afterwards.

CHAPTER 17. REMOVAL OF WATER

17.1 Sometimes water may get collected in inset light. Water inside the light increases corrosion, causes damage to electrical parts and deposits on lens and lamp and, furthermore, reduces the life of the lamp. Before installing an inset light into the pavement, good drainage must be ensured. Nevertheless, penetration of moisture and accumulation of water cannot be precluded completely. Regular inspection is necessary to check lights for the presence of water. Lights found to be wet inside should be removed and replaced, if such a procedure is possible with the type of light. Otherwise, drying must be carried out on the spot. After drying, the sealing should be checked carefully and replaced when necessary. Before closing a dried light, the lamp should be switched on for some time to permit any residual moisture to evaporate due to the temperature increase inside.

17.2 Attention should be paid to the presence of water on and in front of the glass of inset lights. Water may bend the light beam, thus misaligning the light direction. If such a situation is observed, the drainage has to be improved.

CHAPTER 18. SIGNS

18.1 Signs provides directional information to pilots for taxiing and holding. Maintenance should ensure integrity and perfect legibility of the information provided by the signs. The design and construction of signs varies considerably therefore the following general checks and maintenance action are recommended for each sign:

A. *Daily*

- ✓ Lighting; replacing burnt-out lamps
- ✓ Inscriptions for legibility and absence of obstructions; repairing the signs and removing obstructions.

B. *Annually*

- ✓ Mounting of both the sign and its lighting if provided; repairing

- ✓ Structure and its paint; cleaning, repairing or replacing.

C. *Unscheduled*

- ✓ After severe storms; re-positioning tumbled signs and repairing damaged signs.

CHAPTER 19. MARKINGS

19.1 All markings on paved areas should be inspected as specified in aerodrome manual or at least semi-annually. Local conditions will determine when to inspect.

19.2 Markings which are faded or discolored by soil should be repainted. When rubber deposits have been removed from the pavement all defaced markings should be restored as soon as possible.

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