

## COMMISSIONING OF AGL SYSTEMS

SYSTEM COMPONENTS/ PHASES	RECOMMENDED TASK	ADDITIONAL NOTES
Series Circuit Transformer (New)	For each Series Circuit Transformer with the secondary bonded to the core and earth, test the insulation resistance of the primary to earth with a 1kV insulation tester. On transformers without an earth bond on the secondary, test primary and secondary to earth and primary to secondary insulation resistance.	Produce a test result sheet referenced as an Appendix to the Commissioning Plan.
Series Circuit Transformer (Used)	Any transformers, which may have been removed from the installation and is to be re-used shall be subjected to a 24 hour "soak test" prior to testing with a 1kV insulation tester	Produce a test result sheet referenced as an Appendix to the Commissioning Plan.
AGL Cable	All circuits shall be positively identified and labelled with correct circuit identification marking in compliance with circuit identification requirement detailed in JSP 554 <sup>1</sup> .	Labelling to be printed and indelible. Produce a record sheet referenced as an Appendix to the Commissioning Plan.
	Tests shall be conducted on each section of cable to earth, no greater than 1 km in length, prior to backfilling. Each test shall meet the minimum resistance to earth for cable as detailed in PI 29/2005 <sup>2</sup> Figure 4.	Produce a test result sheet referenced as an Appendix to the Commissioning Plan.

<sup>1</sup> JSP554 Military Aviation Aerodrome Standards and Criteria

<sup>2</sup> Policy Instruction 29/2005 Installation, commissioning and maintenance of aeronautical ground lighting cable circuits

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SYSTEM COMPONENTS/ PHASES	RECOMMENDED TASK	ADDITIONAL NOTES
AGL Circuit sections	Tests shall be conducted on each section of circuit, including connected series circuit transformers, to earth, no greater than 1 km in length, prior to backfilling. Resistance values shall not be less than the calculated value as detailed in PI 29/2005 <sup>2</sup> . Typically transformers and cable sections will have insulation resistance values in excess of 1GΩ.	Produce a test result sheet referenced as an Appendix to the Commissioning Plan.
Series Circuit Transformer Earth Connection Verification	After completion and backfilling of trenches a test shall be made to prove that the secondary windings of transformers are connected to the protective conductor and to the earth electrodes or the earth bar in the 'B' Centre.	Produce a test result sheet referenced as an Appendix to the Commissioning Plan.
CCR Commissioning	CCR commissioning should follow all stages as recommended by the manufacturer which should include but not be limited to: All connection check, Input Voltage Check, Output Tapping Check according to calculated load.	Produce a Record Check sheet referenced as an Appendix to the Commissioning Plan.
CCR Commissioning	CCR commissioning should follow all stages as recommended by the manufacturer which should include but not be limited to: Open Circuit Trip, Overcurrent Trip, Lamps Out Alarm/Trip, Earth Fault Alarm/Trip.	Produce a test result sheet referenced as an Appendix to the Commissioning Plan.
CCR Commissioning (Brilliance)	Brilliance adjustments should follow all stages as recommended by the manufacturer with settings adjusted to those corresponding to JSP 554 <sup>1</sup> .	Produce a Record Sheet referenced as an Appendix to the Commissioning Plan and values entered in "As Built Documentation".

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Earthing Certification	After a certificate issued from the installation organisation, stating that all exposed conductive parts in the installation are earthed, has been accepted by the client or representative, tests for continuity and insulation resistance shall be carried out.	Earth test may be witnessed prior to Certification Acceptance
Safety Datum	For each circuit installed the Safety Datum as defined in PI 29/2005 <sup>2</sup> shall be calculated.	Circuit Safety Datum values to be recorded as an Appendix to the Commissioning Plan and results entered in "As Built Documentation"
Maintenance Remedial Level	For each circuit installed the Maintenance Remedial Level as defined in PI 29/2005 <sup>2</sup> shall be calculated.	Circuit Maintenance Remedial Level values to be recorded as an Appendix to the Commissioning Plan and results entered in "As Built Documentation"
Maintenance Datum	For each circuit installed the Maintenance Datum as defined in PI 29/2005 <sup>2</sup> shall be calculated.	Circuit Maintenance Datum values to be recorded as an Appendix to the Commissioning Plan and results entered in "As Built Documentation"
Commissioning Datum	For each circuit installed the Commissioning Datum as defined in PI 29/2005 <sup>2</sup> shall be calculated and compared with measured value.	Circuit Commissioning Datum values to be recorded as an Appendix to the Commissioning Plan and results entered in "As Built Documentation"
Continuity Check and Resistance Measurement	The continuity resistance of series circuits shall be measured and the value obtained must accord with the estimated value of 3.02 ohms per 1000 m of 6mm <sup>2</sup> cable plus 0.4 ohms per series circuit transformer.	Circuit Resistance to be recorded as an Appendix to the Commissioning Plan and results entered in "As Built Documentation"

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Minimum time for conducting Insulation Resistance tests	Establish a minimum time for conducting each test. For readings of insulation resistance, the instrument shall be operated for a definite length of time, either 30 seconds to 1 minute, and read at the end of that time. All future tests shall be conducted with the same length of operating time.	Established Test Time and Test Voltage (if not at 3000V) shall be recorded on the Insulation Test Appendix.
Initial (1 <sup>st</sup> ) Insulation Test (Disconnected from CTP)	Initial Insulation Resistance Test. After continuity test to record the resistance to earth value and to verify circuit is within the Safety Datum Level.	Circuit Insulation Resistance to be recorded as an Appendix to the Commissioning Plan and results entered in "As Built Documentation"
Second (2 <sup>nd</sup> ) Insulation Test (Connected at CTP)	Initial Insulation Resistance Test. After continuity test to record the resistance to earth value and to verify circuit is within the Safety Datum Level.	Circuit Insulation Resistance to be recorded as an Appendix to the Commissioning Plan and results entered in "As Built Documentation"
Third (3rd) Insulation Test (Connected at CTP)	After the installation has been operated at full intensity for not less than six hours and while the series circuit transformers are still warm	Circuit Insulation Resistance to be recorded as an Appendix to the Commissioning Plan and results entered in "As Built Documentation"
Forth (4th) Insulation Test (Disconnected from CTP)	After the installation has been operated at full intensity for not less than six hours and while the series circuit transformers are still warm	Circuit Insulation Resistance to be recorded as an Appendix to the Commissioning Plan and results entered in "As Built Documentation"
Fifth (5th) Insulation Test (Connected at CTP)	At least three hours later when the series circuit transformers have cooled	Circuit Insulation Resistance to be recorded as an Appendix to the Commissioning Plan and results entered in "As Built Documentation"

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SYSTEM COMPONENTS/ PHASES	RECOMMENDED TASK	ADDITIONAL NOTES
Sixth (6th) Insulation Test (Disconnected from CTP)	At least three hours later when the series circuit transformers have cooled	Circuit Insulation Resistance to be recorded as an Appendix to the Commissioning Plan and results entered in "As Built Documentation"
Insulation Resistance Test (CTP back to Regulator)	Each test to be performed in accordance with PI 29/2005 <sup>2</sup> .	Circuit Insulation Resistance to be recorded as an Appendix to the Commissioning Plan and results entered in "As Built Documentation"
Commissioning Datum Results	<p>For new circuits the Commissioning Datum shall comply with PI 29/2005<sup>2</sup> Annex B - Commissioning requirements for the installation of new and refurbished works on AGL primary cable circuits.</p> <p>Minimum Commissioning Datum Level (CDL)</p> $C_{dl} = 3000 / (0.02\mu A \times \text{No of series circuit transformer} + 0.02\mu A \times \text{cable length in m}/100). \Omega$ <p>The actual leakage current, measured at commissioning stage, should be used in the above calculation when this is less than the calculated value.</p>	Circuits shall not be accepted until remedial works are completed to achieve expected Commissioning Values at set precedent.
CTP Labelling	CTP to be labelled with correct circuit identification to JSP 554 <sup>1</sup> & including brilliancy step current, Safety Datum, Maintenance Datum, Maintenance Remedial Level, Commissioning Value.	Labelling to be printed and indelible.

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SYSTEM COMPONENTS/ PHASES	RECOMMENDED TASK	ADDITIONAL NOTES
Elevated Luminaires	Check all frangible couplings are correctly installed	Produce a Record Check Sheet referenced as an Appendix to the Commissioning Plan.
Elevated Luminaires	Check all screws and or nuts and bolts are secure.	Produce a Record Check Sheet referenced as an Appendix to the Commissioning Plan.
Elevated Luminaires	Check all luminaires are set to the correct alignment in accordance with JSP 554 <sup>1</sup> .	Tolerance to be within $\pm 1/2^{\circ}$ Produce a Record Sheet referenced as an Appendix to the Commissioning Plan and variations $\pm 1/2^{\circ}$ entered in "As Built Documentation".
Elevated Approach Luminaires	Check all luminaires mounted above 2M are earthed.	Produce a Record Check Sheet referenced as an Appendix to the Commissioning Plan.
Inset Luminaires	Check all screws and or nuts and bolts are secure.	Produce a Record Check Sheet referenced as an Appendix to the Commissioning Plan.

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SYSTEM COMPONENTS/ PHASES	RECOMMENDED TASK	ADDITIONAL NOTES
Inset Luminaires	Check all screws and or nuts and bolts are within tolerance with respect to installed seating ring or pot.	Check with manufacturer if in doubt. No protrusions above tolerance are acceptable.
Inset Luminaires	Check all luminaires are set to the correct alignment in accordance with JSP 554 <sup>1</sup> .	Tolerance to be within $\pm 1/2^{\circ}$ Produce a Record Sheet referenced as an Appendix to the Commissioning Plan and variations $\pm 1/2^{\circ}$ entered in "As Built Documentation".
PAPI Installations	Check all installation levels. Tolerance between units and Runway Centreline $\pm 300\text{mm}$ . Tolerance between units $\pm 25\text{mm}$	Adjust as necessary. Produce a Record Sheet referenced as an Appendix to the Commissioning Plan and variations from datum entered in "As Built Documentation".
PAPI Installations	Check cross fall of each unit is $0^{\circ}$ . Set each unit to appropriate setting angle for the required resultant glide slope.	Adjust as necessary. Tolerance to be within $\pm 1.0'$ (minute) Produce a Record Sheet referenced as an Appendix to the Commissioning Plan and variations $\pm 1.0'$ entered in "As Built Documentation".
PAPI Flight Acceptance Check	Arrange for Flight Check of system for appropriate signals as detailed in JSP 554 <sup>1</sup>	Contractor should be on site to make any final adjustments.

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<b>SYSTEM COMPONENTS/ PHASES</b>	<b>RECOMMENDED TASK</b>	<b>ADDITIONAL NOTES</b>
All AGL Luminaires	Check all luminaires at each location is marked with an identification number legible, where practicable, from a passing vehicle in compliance with JSP 554 <sup>1</sup> para. 225.100.1	Produce a Record Check Sheet referenced as an Appendix to the Commissioning Plan and enter identifications in “As Built Documentation”.
Photometric Testing of AGL Systems	The Photometric Performance of each AGL system shall be measured by an APPROVED Mobile Photometric Testing Device to demonstrate that the installed luminaire design performance is operating at 100%, or above, of the Isocandela Figures referenced in JSP 554 <sup>1</sup> .	Photometric measurements shall be generated and presented in tabular and bar chart formats



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**EXAMPLE IR TEST COMMISSIONING SHEET**

<b>A Contractors Name</b>	TEST 1 TIME START:	17.40 Hrs	TEST 2 TIME START:	20.35 Hrs
TEST DATE: 17th January 2006	TEST 1 TIME COMPLETED:	18.30 Hrs	TEST 2 TIME COMPLETED:	20.50 Hrs
TEST INSTRUMENT	BM21	Serial No. 040804/6041	Calibrated: 03/10/2005	Weather: Light Rain / Wet Ground

  

<b>Circuit Test Voltage (Volts)</b>					<b>3000</b>								
Circuit Reference	Circuit Description	Circuit Length (Metres)	Quantity of Series Circuit Transformers	Continuity Resistance(Ohms)	Minimum Commissioning Datum (Megaohms)	Maximum Leakage Current (MicroAmps)	Test Readings Prior to Soak Test	Test Readings Post 6 Hours Disconnected	Test Readings Post 9 Hours Disconnected	Maintenance Datum Level (Megaohms)	Safety Datum Kohms	Test Engineer's Signature	
A	Example	8000	100		833.33	3.600				535.71			
1	08 Runway C/L B	7600	51	21.8	1181.10	2.540	2800.000	4200.00	5250.00	842.70	0.130		
2	08 PAPI A	3000	12	7	3571.43	0.840	11100.000	27800.00	39400.00	2777.78	0.065		
3	08 PAPI B	3000	12	6.5	3571.43	0.840	8990.000	19900.00	26600.00	2777.78	0.065		
6	08 Threshold A	1300	9	3.5	6818.18	0.440	4060.000	29000.00	38400.00	4838.71	0.130		
7	08 Threshold B	1300	9	3.6	6818.18	0.440	4540.000	29200.00	37200.00	4838.71	0.130		
8	Runway Edge B	8500	76	27.6	931.68	3.220	113.000	244.00	250.00	632.91	0.130		
9	Runway Edge D	8500	76	25.3	931.68	3.220	300.000	310.00	252.00	632.91	0.130		
10	08 Approach A	4000	60	12.6	1500.00	2.000	13100.000	1870.00	2240.00	937.50	0.130		
11	08 Approach B	4000	68	12	1388.89	2.160	428.000	690.00	740.00	852.27	0.130		
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## COMMISSIONING OF AGL SYSTEMS

Once the installation of the new AGL and associated MCS equipment has been completed all circuits shall be tested. After successful completion of the testing the MCS/AGL, the Contractor shall offer the system to SATCO for testing.

The following table will form the basis for a comprehensive testing regime.

The SATCO is responsible for ensuring that testing takes place to ensure that when offered for testing the new AGL works perform correctly as demanded by the MCS. This testing shall also include testing of all the other MCS circuits to ensure that the new circuits have not adversely affected the present operation of MCS/AGL installation.

It should be agreed that wherever possible the testing shall take place outside of the times for flying operations. However, if this is not possible then the aircrew shall be made aware of the situation. The testing of the circuits will be greatly assisted by training provided by the Contractor to station personnel covering the scale of the modification to the MCS/AGL.

Caution shall be exercised during the testing by ATC personnel as the significant amount of testing of multiple circuits together with associated changes to brilliancy settings etc may create thermal shock within the light-bulbs (in particular). It is therefore recommended that the testing be carried out with the active assistance of the station based airfield electricians.

To ensure the functional safety (the Safety Case) and standardisation of the MCS, a formal approval process exists between the MOD and the Support Contractor for all MCS changes/upgrades. This process is applied irrespective of whether the proposals are for standard or non-standard modifications. Standard and non-standard changes are defined in PI 19/2006 "Mandatory services available via a 'call off' contract to support the Modular Control System (MCS) installations on all MOD Aerodromes" Paragraph 6.

## COMMISSIONING OF AGL SYSTEMS

MCS LIGHTING SYSTEM COMMISSIONING REQUIREMENT		
SYSTEM COMPONENTS / PHASES	MCS FUNCTION	ADDITIONAL NOTES
Lighting Panel	<p>To indicate the state of lights associated with each switch, i.e. on, off, failed;</p> <p>To indicate the state of the Barrier Arrest System;</p> <p>To change the brilliancy of lights;</p> <p>To indicate failures in the lights/system;</p> <p>To provide a communications point to an engineer;</p> <p>To allow selection of the runway in use;</p> <p>To not allow more than one runway to be indicated as the approach/landing runway at the same time.</p>	Check for correct indications from the switches
Approach	<p>To turn all centre line and cross bar lights on for the selected runway when required;</p> <p>To turn all centre line and cross bar lights off for the selected runway when required;</p> <p>To feedback the state of the approach lights for the selected runway to the lighting panel, i.e. on, off, failed.</p>	Each circuit to be tested individually at all intensities and then in conjunction with all other circuits.
Threshold Bar	<p>To turn all threshold bar lights on for the selected runway when required;</p> <p>To turn all threshold bar lights off for the selected runway when required;</p> <p>To feedback the state of the threshold bar lights for the selected runway to the lighting panel, i.e. on, off, failed.</p>	Each circuit to be tested individually at all intensities and then in conjunction with all other circuits.
Threshold Wing Bar	<p>To be turned on by the same switch as the Threshold Bar;</p> <p>To be turned off by the same switch as the Threshold Bar;</p> <p>To feedback the state of the lights for the selected runway to the threshold wing bar switch on the lighting panel, i.e. on, off, failed.</p>	Each circuit to be tested individually at all intensities and then in conjunction with all other circuits

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MCS LIGHTING SYSTEM COMMISSIONING REQUIREMENT		
SYSTEM COMPONENTS / PHASES	MCS FUNCTION	ADDITIONAL NOTES
PAPI	To turn all PAPI lights on for the selected runway as required; To turn all PAPI lights off for the selected runway as required; To feedback the state of the PAPI lights for the selected runway to the lighting panel, i.e. on, off, failed.	Each circuit to be tested individually at all intensities and then in conjunction with all other circuits.
Runway	To turn all runway lights on for the selected runway when required; To turn all runway lights off for the selected runway when required; To feedback the state of the runway lights for the selected runway to the lighting panel, i.e. on, off, failed.	Each circuit to be tested individually at all intensities and then in conjunction with all other circuits.
Runway Distance Marker Lights	To be turned on by the same switch as the runway lights; To be turned off by the same switch as the runway lights; To feedback the state of the runway distance marker lights for the selected runway to the runway switch on the lighting panel, i.e. on, off, failed.	Each circuit to be tested individually at all intensities and then in conjunction with all other circuits.
Mast / Obstruction Lights	To turn all obstruction lights on when required; To turn all obstruction lights off when required; To feedback the state of the obstruction lights to the lighting panel, i.e. on, off, failed.	Each circuit to be tested individually at all intensities and then in conjunction with all other circuits.
Identification Beacon	To turn ID Beacon on when required; To turn ID Beacon off when required; To feedback the state of the ID Beacon to the lighting panel, i.e. on, off, failed.	The circuit to be tested individually and then in conjunction with all other circuits.
Traffic Lights	To turn individual, or specified sets, traffic lights to red when required; To turn individual, or specified sets, traffic lights to green when required; To feedback the state of the individual traffic lights to the lighting panel, i.e. on, off, failed.	The circuit to be tested individually and then in conjunction with all other circuits.

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MCS LIGHTING SYSTEM COMMISSIONING REQUIREMENT		
SYSTEM COMPONENTS / PHASES	MCS FUNCTION	ADDITIONAL NOTES
Undercarriage Check Lights	To turn the undercarriage check lights on when required; To turn the undercarriage check lights off when required; To feedback the state of the undercarriage check lights to the lighting panel, i.e. on, off, failed.	Each circuit to be tested individually at all intensities and then in conjunction with all other circuits.
Taxiway lights	To turn lights on for the selected taxiway section when required; To turn lights off for the selected taxiway section when required; To feedback the state of each taxiway section lights to the lighting panel, i.e. on, off, failed.	Each circuit to be tested individually at all intensities and then in conjunction with all other circuits. Note that these circuits also include the modifications for the DDF access taxiway.
Holding Position Board Lights	To be turned on when the relevant taxiway section lights are turned on; To be turn off when the relevant taxiway section lights are turned off; To feedback the state of the lights to the relevant taxiway switch on the lighting panel.	To be turned on by the same switch as the taxiway lights;
Airfield Blackout button	To turn off all airfield lights when required; To turn on all airfield lights when required;	To blackout and restore the airfield lighting when required. This particular testing may not be required and the shock to the system as a whole can be significant and expert advice should be sort from the resident airfield electricians
Airbase Blackout button	To turn off all airbase lights when required; To turn on all airbase lights when required.	See notes for Airfield Blackout.

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MCS LIGHTING SYSTEM COMMISSIONING REQUIREMENT		
SYSTEM COMPONENTS / PHASES	MCS FUNCTION	ADDITIONAL NOTES
Hardstanding	To turn the hardstanding entrance lights on when required; To turn the hardstanding entrance lights off when required; To feedback the state of the hardstanding entrance lights to the lighting panel, i.e. on, off, failed.	Each circuit to be tested individually at all intensities and then in conjunction with all other circuits.
Aircraft-Servicing and Platforms	To turn the area outline lights on when required; To turn the area outline lights off when required; To feedback the state of the area outline lights to the lighting panel, i.e. on, off, failed.	Each circuit to be tested individually at all intensities and then in conjunction with all other circuits.



DEFENCE ESTATES SITE TEST SPECIFICATION OF REQUIREMENTS FOR  
PHOTOMETRIC TESTING AT COMMISSIONING AND MAINTENANCE TEST  
MEASUREMENTS OF AERONAUTICAL GROUND LIGHTING SYSTEMS

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**1.0 Specification for Photometric Test Measurements at Commissioning of New AGL Systems.**

1.1 Photometric measurement to ensure compliance

New, refurbished or modified installations where more than 25% of the system has been changed is to be subject to a photometric compliance test at commissioning stage.

1.2 Commissioning Acceptance criteria for photometric tests.

1.2.1 The Photometric Performance of each AGL system is to be measured by an APPROVED Mobile Photometric Testing Device (See PG 01/2008 - Annex F<sup>1</sup>) to demonstrate that the installed luminaire performance is operating at 100%, or above, of the requirements for the specific system defined in the Isocandela Figures referenced in JSP 554<sup>2</sup>. Approval of a Mobile Photometric Testing Device is authorised by Defence Estates – Construction Support Team (DE-CST) after an assessment of the system compliance with specification criteria detailed in PG 01/2008 - Annex F.

1.2.2 To ensure photometric compliance is achieved in good time, to comply with JSP 554 105.110.4 - Handover documentation, the contractor is advised to forward a copy of the photometric report to DE-CST for review.

1.3 Commissioning Pre-requisites prior to Photometric Test Measurements.

1.3.1 The Contractor shall ensure and verify that all the following pre-requisites have been completed and checked prior to the arrival of the Photometric Test Team.

1.3.2 Series Circuits have been commissioned in accordance with PI 29/2005<sup>3</sup> titled "Installation, commissioning and maintenance of aeronautical ground lighting cable circuits" Annex B Commissioning requirements for the installation of new and refurbished works on AGL primary cable circuits.

1.3.3 Constant Current Regulators (CCR's) have been commissioned in accordance with the manufacturers' instructions and that brilliancy outputs have been set to those detailed in JSP 554 Table 220-4.

1.3.4 AGL luminaires are supplied by the correct wattage of Series Circuit Transformer for the particular service



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- 1.3.5 AGL luminaires have the correct wattage lamp installed for the particular service.
- 1.3.6 AGL luminaires have been correctly aligned and within tolerance in accordance with JSP 554 Annex B to 205. Elevation and alignment checks to verify compliance with JSP 554 Annex B, are to be made using a calibrated alignment tool. Inset seating ring level and alignment should be correct at time of installation. These checks do not establish misalignments due to failure in the light fittings internal components or lamps. Misalignments within a fitting can only be determined by the use of a Mobile Photometric Measurement device such as “MALMS”
- 1.3.7 AGL luminaires fixings are tightened to the manufacturers recommended torque settings
- 1.3.8 AGL luminaires are identified in accordance with JSP 554 225.100.1
- 1.3.9 AGL luminaires have been cleaned within 24-48 hours of the test measurement. If there has been rain, then for inset fixtures, remove any excess surface water in front of the AGL luminaire lens.
- 1.3.10 AGL luminaires are clear of debris and vegetation (within a 5 m. radius).
- 1.3.11 No open pits, ducts, trenches are to be open within a 5 m. radius of AGL luminaries. Any open pits, ducts or trenches will make it difficult or impossible to undertake complete and correct measurement of luminaires. Services such as Threshold / Wing Bar / Runway End / Approach Bar could be tested using a transverse method that requires the approved testing (measuring) product to drive in front of each of the above services; therefore any obstacles can make the test invalid.
- 1.3.12 A Site Engineer, with suitable tools and spares such as fixtures, lamps, transformers and alignment tools is to be available during photometric testing of the AGL. The Engineer may also be required to switch between AGL services for testing purposes as well as to confirm that correct AGL settings have been used. It may be possible to identify immediately some faulty AGL luminaires, and therefore allow an opportunity for the engineer to undertake immediate rectification work. If time is available a second test could be undertaken to establish if the identified rectification work has improved the AGL serviceability
- 1.3.13 Should the newly commissioned AGL system fail the photometric measurement test, then a re-test may be necessary. If so, all of the aforementioned requirements are necessary prior to the second re-test. It is recommend that a review of the AGL photometric measurement report is undertaken and discussions held with TMS Engineers and DE-





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CST to establish possible areas of failure and what rectification work is to be undertaken.



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**2.0 Specification for Photometric Test Measurements as a Maintenance Tool.**

2.1 Maintenance Objectives.

- 2.1.1 The objectives contained in Table 1 specifically target precision approach runways and operations in low visibility. For precision approach runways the aerodrome authority is expected to provide evidence that the performance of the associated AGL meets the requirements for all weather operations, which include Table 1. One method of providing such evidence is to carry out regular measurements of the photometric performance (i.e. the luminous intensity, beam coverage and alignment) of the AGL when in service (Source – JSP 554, Section 225).
- 2.1.2 A light is to be deemed to be unserviceable when the main beam average intensity is less than 50% of the value specified in the appropriate figure detailed in JSP 554 Table 205B-1 Annex B. For light fittings where the designed main beam average intensity is above the value shown in JSP 554, the 50% value is to be related to the design value. In order to verify serviceability levels are being maintained a formal procedure for the photometric measurement and recording of serviceability is to be implemented. This may take the form of an approved rapid speed photometric measurement equipment in compliance with the extant specification or measurements taken by a hand held Luxmeter with the average candela commuted from three readings. Both methods are detailed in Annex F of Policy Instruction 05/2007.
- 2.1.3 In order to provide continuity of guidance an unserviceable light is not to be permitted adjacent to another unserviceable light unless the light spacing is significantly less than that specified.

AGL Service	LANDING	
	CAT I	CAT II/III
Approach beyond 450m	85%	85%
Approach inner 450m	85%	95%
Runway threshold	85%	95%
Runway end	85%	85%
Runway edge	85%	95%
Runway centre line (where fitted)	85%	95%
TDZ (where fitted)	85%	90%

**Table 1 AGL Serviceability Levels**



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## DEFENCE ESTATES SITE TEST SPECIFICATION OF REQUIREMENTS FOR PHOTOMETRIC TESTING AT COMMISSIONING AND MAINTENANCE TEST MEASUREMENTS OF AERONAUTICAL GROUND LIGHTING SYSTEMS

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### 2.2 Maintenance strategy

- 2.2.1 The conventional AGL maintenance strategies of block change or change on failure, have been shown to be inadequate with many of the lamps failing to meet the required standard either immediately or shortly after the maintenance activity. Lamps and associated equipment do not age at a uniform rate and consequently only limited benefit is achieved from a routine block change. On the other hand, if the performance of individual lights is allowed to decay until lamp failure occurs, then each light will be operating below the required standard for a substantial percentage of its life. Both strategies result in the possibility of entering Low Visibility Procedures (LVP's) with the installation operating below the required serviceability levels. Routine and regular targeted maintenance procedures are essential if this scenario is to be avoided.
- 2.2.2 The performance of lights can change rapidly, especially at large aerodromes with high movement rates. Therefore, it is important to assess performance accurately on a regular basis and act upon the information collected. The frequency with which such assessments are to be undertaken is dependant upon the type and age of the installation, maintenance policy adopted, movement rates and prevailing weather conditions.
- 2.2.3 The overall performance of AGL can be dramatically improved and maintained with the introduction of an adequate cleaning regime. The nature of their general location makes inset fittings particularly susceptible to the presence of dirt, dust, moisture and the effects of heavy loads. Staining of the glassware and rubber deposits can considerably reduce the light output of these lights and reductions of the order of 50% are not uncommon. The periodicity of AGL cleaning will depend upon environmental and operating conditions.
- 2.2.4 Changing the light fitting will not always ensure the required performance is achieved since the luminous intensity of the beam is dependent on the total electrical and optical system. The importance of maintaining the primary series circuit current is only a single factor in the system and additional work may be required at specific locations, for instance a faulty transformer or a slightly dirty lens can reduce output by up to 50%. A single application of de-icing fluid to a runway can reduce the light output of centreline lights by up to 70%.
- 2.2.5 PI 07/2005<sup>4</sup> Property Management of the Defence Estate - DE (W) Specification 005 Issue 003 (Revised Schedules A to F) reference Schedule C Task 158.1 details the mandatory requirement to clean Approach, Runway and Taxiway services on a monthly basis.
- 2.2.6 DE-CST have conducted a number of trials across the MOD Estate which suggest that a quarterly or bi-annual survey, with associated maintenance, may be adequate where "condition based maintenance" is adopted.



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2.2.7 By assessing the performance of each light on a regular basis and targeting maintenance on the under-performing light, the overall performance of the installation can be considerably improved. Targeting work on those fittings that are under-performing ensures that maximum benefit can be obtained from maintenance activity thereby minimising wastage and enabling maintenance expenditure to be optimised.

### 2.3 Condition Based Maintenance

2.3.1 Condition Based Maintenance targets work by using in-field measurements to identify when, where and what corrective action if any is required. Serviceability levels are maintained in an effective and efficient manner by:

- a. Measurement: The routine collection of accurate, reliable and timely performance data, using a mobile measurement system.
- b. Targeted Maintenance: Work is scheduled on the basis of the recorded measurements and targeted on those specific light fittings that are below or fast approaching the pre-defined serviceability level, and basing the work required on the specific needs of that location.
- c. Monitoring: Assessment of the effectiveness of the maintenance work based on additional photometric measurements. Additional work to be undertaken if performance remains low.
- d. Management: The maintenance loop is closed by control procedures and actions.

2.3.2 This approach takes into account all the variable factors that are found to contribute to light fitting performance deterioration, and effectively identifies maintenance priorities. It is also aimed at obtaining the maximum benefit from any maintenance activity, thereby utilising resources in an efficient and effective manner. The measurement and rectification frequency required to maintain the JSP 554 serviceability standards will vary according to:

- a) Movement rates
- b) Mix of aircraft types
- c) Runway Category
- d) Environmental conditions
- e) Age and condition of equipment



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- f) Specification of equipment



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### 2.4 Photometric Testing

- 2.4.1 Regular photometric measurements are the only practical way of determining if the light fittings are meeting the specified regulated requirements and for determining misalignment errors. By the use of regular photometric measurements, maintenance of light fittings may be targeted only where needed thereby saving resources and time while allowing the aerodrome to be assured of meeting light output specifications, especially in low-visibility conditions. The required frequency of photometric measurements will vary from aerodrome to aerodrome and from runway to runway depending on amount of traffic, environment and age of fixtures, etc. After experience has been gained with the measurement equipment and the determination of light output, inspection schedules may be evaluated. Due to the susceptibility of runway centreline and touchdown zone lights to accumulate rubber deposits on the lens, weekly checks may be necessary. This is especially true for CAT II runways where low visibility operations are conducted. As a minimum photometric testing should be performed:
- a. Before cleaning, to establish whether cleaning is necessary, and
  - b. After cleaning, to check the effectiveness of the cleaning and determine the degradation of the internal optical assembly. Lights that are below minimum levels are to be scheduled for removal and servicing.
- 2.4.2 Consider Table 1 and the AGL serviceability requirements in CAT I: Where a given systems serviceability is below 85%, that is where 15% of unserviceable fittings are below 50% of the initial light design output requirement, when new; the Facilities Manager should instigate a programme of increased “Targeted Maintenance” until the system serviceability is again re-established. Monitoring and assessment of the effectiveness of the maintenance work based on additional photometric measurements is a key element to determine where additional work is to be undertaken if performance remains low.
- 2.4.3 Any light fitting with measured output of less than 70% of the initial design output required when new is ineffective for high background, low visibility conditions.
- 2.4.4 Photometric Testing equipment is now available to allow for rapid and accurate testing of the output of both in-pavement and elevated runway lighting fixtures (See PG 01/2008 and Annex F Specification Requirements for Mobile Photometric Measurement Tool).
- 2.4.5 Equipment is also now available to perform photometric testing in the maintenance workshop to verify that a refurbished light fitting is meeting the required specification prior to being reinstalled in the runway or taxiway (See



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PG 01/2008 and Annex F Specification Requirements for Mobile Photometric  
Measurement Tool).





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- 2.5 Maintenance Pre-requisites prior to Routine Photometric Test Measurements.
- 2.5.2 The Contractor shall ensure and verify that all the following pre-requisites have been completed and checked prior to the arrival of the Photometric Test Team.
  - 2.5.3 Series Circuits have been maintained in accordance with PI 29/2005 titled "Installation, commissioning and maintenance of aeronautical ground lighting cable circuits"
  - 2.5.4 Constant Current Regulators (CCR's) have been maintained in accordance with the manufacturers' instructions and that brilliancy outputs have been set to those detailed in JSP 554 Table 220-4.
  - 2.5.5 AGL luminaires are supplied by the correct wattage of Series Circuit Transformer for the particular service
  - 2.5.6 AGL luminaires have the correct wattage lamp installed for the particular service.
  - 2.5.7 AGL luminaires have been correctly aligned and within tolerance in accordance with JSP 554 Annex B to 205. Routine elevation and alignment checks to verify compliance with JSP 554 Annex B, are to be made using a calibrated alignment tool. Inset seating ring level and alignment should be correct at time of installation. These checks do not establish misalignments due to failure in the light fittings internal components or lamps. Misalignments within a fitting can only be determined by the use of a Mobile Photometric Measurement device such as "MALMS"
  - 2.5.8 AGL luminaires fixings are tightened to the manufacturers recommended torque settings
  - 2.5.9 AGL luminaires are identified in accordance with JSP 554 225.100.1
  - 2.5.10 Work has been completed as scheduled on the basis of the previous recorded measurements and targeted on those specific light fittings that are below or fast approaching the pre-defined serviceability level.
  - 2.5.11 AGL luminaires are clear of debris and vegetation.



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**REFERENCES**

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- 1 IN 12/2007 Management of Visual Aids at Military Aerodromes
  - 2 JSP 554 Military Aviation, Aerodrome Standards And Criteria
  - 3 PI 29/2005 Installation, commissioning and maintenance of aeronautical ground lighting cable circuits
  - 4 PI 07/2005 Property Management of the Defence Estate - DE (W) Specification 005 Issue 003 (Revised Schedules A to F)