

COMPLIANCE

OF SAGA SOLAR AIRFIELD LIGHTING **WITH INTERNATIONAL MILITARY REGULATIONS**



Table of Contents

Introduction	3
Chapter 1. Compliance of SP-401 Airfield Lights	4
SP-401 Unit as the key component of S4GA Airfield Lighting System	4
Compliance with ICAO	5
Photometric Compliance	5
Chromaticity Compliance	7
Jet Blast Resistance Compliance	8
Frangibility Compliance	8
Secondary Power Supply Compliance	9
Electromagnetic Compatibility Compliance	10
Compliance with FAA	12
Compliance with NATO	13
Compliance with USDOD	14
Compliance with AFCEC	14
Chapter 2. Compliance of S4GA ALCMS - Airfield Lighting Control and Monitoring System	15
Compliance of ALCMS Software	15
Compliance of ALCMS Hardware	17
Summary	19
International Aviation Documents	20

Introduction

S4GA delivers World's Safest Runway Lighting

S4GA is a state-owned company that designs, manufactures, and supplies certified airfield lighting systems to civil and military customers worldwide. The Company Head Office, manufacturing facilities and training centre are located in Poland.

S4GA is **ISO 9001:2015 certified** Company. We offer complete airfield lighting solutions for all types of airports and air bases. The Company also serves remote helipads and temporary landing zones.

For military applications, the Company offers the following types of airfield lighting systems:

- Solar permanent airfield lighting
- Emergency airfield lighting system in a Trailer
- Helipad lighting.

As at 2021, S4GA has delivered over 120 projects in 45 different countries on all continents. Our systems are used by air forces in Europe, Africa, Latin America and Asia. We delivered permanent, and emergency airfield lighting systems.



All S4GA airfield lighting products are compliant with international military and aviation regulations. Lighting fixtures have passed multiple tests and are certified by independent accredited laboratories.

This document is a guidance to S4GA airfield lighting compliance with the key norms of ICAO, FAA, STANAG and other military equipment regulatory institutions.



CHAPTER 1. Compliance of SP-401 Airfield Lights

SP-401 Unit as the key component of S4GA Airfield Lighting System

SP-401 airfield light is the key component of S4GA system. It is an intelligent, remotely controlled airfield lighting fixture powered by an integrated power bank.

The light is designed to operate in harsh weather conditions and can withstand desert high temperatures, tropical high humidity climate, and Arctic frozen. SP-401 Lighting Unit is an elevated light mounted to the runway surface with frangible mounting.



Figure 1.1. SP-401 Solar Airfield Light

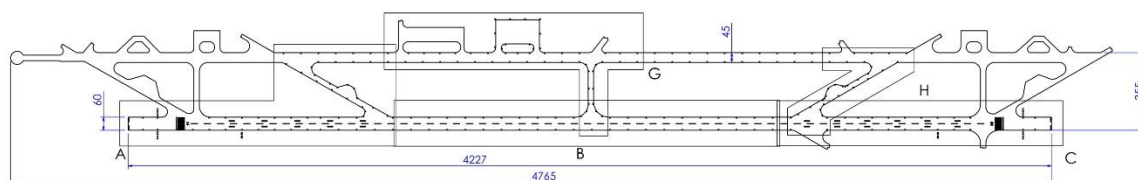


Figure 1.2. Airfield lighting layout with SP-401 Lighting Units

SP-401 lighting unit goes in two versions: portable and solar. Portable version of the light is designed for emergency operations; it has 15 days of autonomy and is charged via a stationary charger.

Solar version of SP-401 is equipped with solar panel and powered by solar energy. Rapid charging technology used in S4GA lights provides 365 days a year of light autonomy. It is designed for permanent applications.

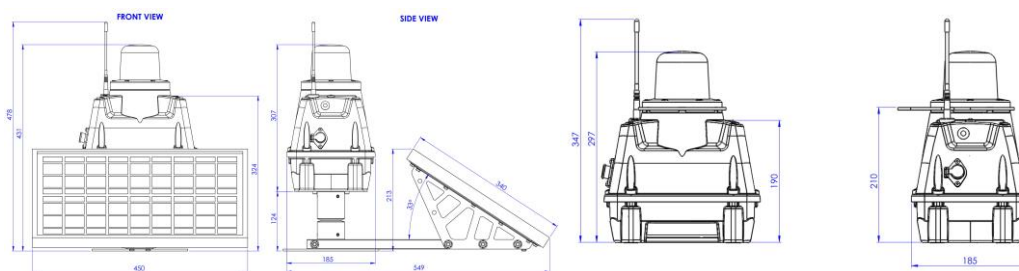


Figure 1.3. Technical drawings of SP-401 Solar and Portable Airfield Lights

SP-401 lighting unit is compliant with norms and regulations issued by International Civil Aviation Organization, Federal Aviation Administration, North Atlantic Treaty Organization and other regulatory bodies. To confirm the compliance, we performed multiple tests of our products by independent institutions such as Intertek Laboratory, Military Institute of Armament Technology, Warsaw Institute of Aviation, EMAG Institute of Innovative Technologies, Laborex Research Laboratory.

S4GA lights have successfully passed testing of photometric & chromaticity, jet blast & wind velocity resistance, frangibility, ingress protection, electromagnetic (EMC) compatibility.

Table 1.1. Compliance of SP-401 lights with ICAO Annex 14 photometric requirements

Clause/Figure/ Appendix	Requirements	S4GA Specification	Test Verification Report	S4GA Compliance
Clause 5.3.4.8 & 5.3.4.9	Simple approach lighting system Recommendation.— Where provided for a non-instrument runway, the lights should show at all angles in azimuth necessary to a pilot on base leg and final approach. The intensity of the lights should be adequate for all conditions of visibility and ambient light for which the system has been provided.	SP-401 Approach Light Light Output (directional): 1 800 cd Optics: 1 Unidirectional type (for extended visibility range) Optics 2: Omni-directional (for circuiting guidance) Color: White	Laboratory: Intertek Accredited: Yes Date of report: 20.12.2019 Number of report: 191200427HZH-001	MEETS
Clause 5.3.8.3 & 5.3.8.4	Runway threshold identification lights should be flashing white lights with a flash frequency between 60 and 120 per minute. The lights shall be visible only in the direction of approach to the runway	SP-401 Runway Threshold Identification Light Light Output (unidirectional): 1 200 cd Color: White Flash frequency: 94 FPM	Laboratory: Intertek Accredited: Yes Date of report: 23.08.2019 Number of report: 190800581HZH-002	MEETS
Clause 5.3.9.8 & 5.3.9.9	Runway edge light – the intensity shall be at least 50 cd	SP-401 Runway Edge Light Light Output (directional): 1 200 cd Optics: 1 Unidirectional type (for extended visibility range) Optics 2: Omni-directional (for circuiting guidance) Color: White	Laboratory: Intertek Accredited: Yes Date of report: 26.03.2019 Number of report: 180400427HZH-010	EXCEEDS
Clause 5.3.9.10	Runway edge lights on a precision approach runway shall be in accordance with the specifications of Appendix 2, Figure A2-9 or A2-10.	SP-401 High Intensity Runway Edge Light Light Output (directional): 16 000 cd Color: White	Laboratory: Intertek Accredited: Yes Date of report: 27.03.2019 Number of report: 180400427HZH-013	EXCEEDS
Clause 5.3.10.9	Runway threshold and wing bar lights shall be fixed unidirectional lights showing green in the direction of approach to the runway	SP-401 Runway Threshold Light Light Output (unidirectional): 450 cd Color: Green	Laboratory: Intertek Accredited: Yes Date of report: 20.08.2018 Number of report: 180400427HZH-004	MEETS
Clause 5.3.10.10	Runway threshold lights on a precision approach runway shall be in accordance with the specifications of Appendix 2, Figure A2-3.	SP-401 High Intensity Runway Threshold Light Light Output (directional): 11 400 cd Color: Green	Laboratory: Intertek Accredited: Yes Date of report: 23.08.2019 Number of report: 190800581HZH-003	EXCEEDS
Clause 5.3.11.4	Runway end lights shall be fixed unidirectional lights showing red in the direction of the runway	SP-401 Runway End Light Light Output (unidirectional): 320 cd Color: Red	Laboratory: Intertek Accredited: Yes Date of report: 20.08.2018 Number of report: 180400427HZH-003	MEETS
Clause 5.3.11.5	Runway end lights on a precision approach runway shall be in accordance with the specifications of Appendix 2, Figure A2-8.	SP-401 High Intensity Runway End Light Light Output (directional): 2 700 cd Color: Red	Laboratory: Intertek Accredited: Yes Date of report: 23.08.2019 Number of report: 190800581HZH-004	EXCEEDS
Clause 5.3.18.7 & 5.3.18.8	Taxiway edge lights shall be fixed lights showing blue. The intensity of taxiway edge lights shall be at least 2 cd from 0° to 6° vertical, and 0.2 cd at any vertical angles between 6° and 75°.	SP-401 Taxiway Edge Light Light Output: ICAO Compliant (max. Intensity 11 cd) Optics Omnidirectional, blue	Laboratory: Intertek Accredited: Yes Date of report: 26.03.2019 Number of report: 180400427HZH-009	EXCEEDS
Clause 5.3.1.11	Runway threshold lights on a precision approach runway On the perimeter of and within the ellipse defining the main beam in Appendix 2, Figures A2-1 to A2-10, the maximum light intensity value shall not be greater than three times the minimum light intensity value measured in accordance with Appendix 2, collective notes for Figures A2-1 to A2-11 and A2-26, Note 2.	Applicable to: SP-401 High Intensity Runway Edge Light SP-401 High Intensity Threshold Light SP-401 High Intensity Runway End Light	Laboratory: Intertek Accredited: Yes Date of report: 23.08.2019 Number of report: 190800581HZH-003	MEETS

Chromaticity Compliance

Chromaticity is the specification of the colour of light output. Different types of airfield lights should be of different colours to be easily identified by pilots. For example, runway edge light has to be white and taxiway light has to be blue. Bluish runway edge lights might mislead pilot during landing and cause catastrophic consequences.

Chromaticity requirements to airfield lights are given in ICAO Annex 14, Volume I. SP-401 lights have been tested in Intertek Laboratory. The lights have passed chromaticity tests for all types of applications: approach, runway edge, threshold, runway end, RTIL, taxiway.

Table 1.2. Compliance of SP-401 lights with ICAO Annex 14 chromaticity requirements

Clause/Figure/Appendix	Requirements	S4GA Specification	Test Verification Report	S4GA Compliance
Appendix 1, Figure A1-1b	Runway approach light - white	SP-401 Approach Light Color: white	Laboratory: Intertek Accredited: Yes Date of report: 20.12.2019 Number of report: 191200427HZH-001	MEETS
	Runway threshold identification light - white	SP-401 Runway Threshold Identification Light Color: white	Laboratory: Intertek Accredited: Yes Date of report: 23.08.2019 Number of report: 190800581HZH-002	MEETS
	Runway edge light – white	SP-401 Runway Edge Light Color: white	Laboratory: Intertek Accredited: Yes Date of report: 26.03.2019 Number of report: 180400427HZH-010	MEETS
	Runway edge light (precision approach runways) – white	SP-401 High Intensity Runway Edge Light Color: white	Laboratory: Intertek Accredited: Yes Date of report: 27.03.2019 Number of report: 180400427HZH-013	MEETS
	Threshold Light – green	SP-401 Runway Threshold Light Color: green	Laboratory: Intertek Accredited: Yes Date of report: 20.08.2018 Number of report: 180400427HZH-004	MEETS
	Threshold Light (precision approach runways) – green	SP-401 High Intensity Runway Threshold Light Color: green	Laboratory: Intertek Accredited: Yes Date of report: 23.08.2019 Number of report: 190800581HZH-003	MEETS
	Runway End light – red	SP-401 Runway End Light Color: red	Laboratory: Intertek Accredited: Yes Date of report: 20.08.2018 Number of report: 180400427HZH-003	MEETS
	Runway End light (precision approach runways) – red	SP-401 High Intensity Runway End Light Color: red	Laboratory: Intertek Accredited: Yes Date of report: 20.08.2018 Number of report: 180400427HZH-003	MEETS
	Taxiway edge light - blue	SP-401 Taxiway Edge Light Color: blue	Laboratory: Intertek Accredited: Yes Date of report: 26.03.2019 Number of report: 180400427HZH-009	MEETS

Jet Blast Resistance Compliance

The jet blast resistance is the ability of airfield lights to withstand jet blast, propeller wash, and surface wind gusts. There are two main documents that specify and regulate jet blast resistance:

- ICAO Aerodrome Design Manual, Doc 9157
- FAA AC 150/5345-50B Specification For Portable Runway And Taxiway Lights.

The same documents regulate resistance of airfield lights to wind velocity (or wind speed).

ICAO requires maximum wind speed resistance of 240

kilometres per hour for low-intensity airfield lights. SP-401

units have been tested on jet blast in Warsaw Institute of Aviation, Laboratory of Aerodynamics. Both portable and solar airfield lights have successfully passed the tests and can withstand 240 km/h wind speed.



Figure 1.5. SP-401 Solar Airfield Light during testing of jet blast resistance in Warsaw Institute of Aviation

Table 1.3. Compliance of SP-401 lights with jet blast requirements

Authority	Document	Clause/Figure/Appendix	Requirements	S4GA Specification	Test Verification Report	S4GA Compliance
ICAO	Aerodrome Design Manual, Doc 9157, Part 6 Frangibility	Clause 3.2.2	Should withstand normal wind loading of 140 km/h; and should be capable of surviving a higher level of wind speed - 210 km/h	All S4GA lights can withstand 240 km/h wind loading	Laboratory: Warsaw Institute of Aviation Accredited: Yes Date of report: 17.12.2019 Number of report: 41/CNTA/19/P	EXCEEDS
		Clause 4.9.1	Should withstand 240 km/h (for low intensity lights)	All S4GA lights can withstand 240 km/h jet blast	Laboratory: Warsaw Institute of Aviation Accredited: Yes Date of report: 17.12.2019 Number of report: 41/CNTA/19/P	MEETS
FAA	FAA AC 150/5345-50B Specification For Portable Runway And Taxiway Lights	Clause 3.2.2	Exposure to wind speeds up to 150 mph (240 km/h) from any direction	All S4GA lights can withstand 240 km/h wind loading	Laboratory: Warsaw Institute of Aviation Accredited: Yes Date of report: 17.12.2019 Number of report: 41/CNTA/19/P	MEETS

Frangibility Compliance

Frangibility of airfield light is the ability to withstand a particular bending force on one side, and ability to be broken at a particular bending moment on the other side. This requirement is applicable only for elevated type of airfield lights. It is predefined and regulated by ICAO and FAA documents:

- ICAO Aerodrome Design Manual, Doc 9157
- ICAO Annex 14, Volume I
- FAA AC 150-5345-46E Specification For Runway And Taxiway Light Fixtures
- FAA AC 150 5220-23 Frangible Connections.

ICAO requirement is 'the yield point should withstand a bending moment of 204 J without failure but should separate cleanly from the mounting system before the bending moment reaches 678 J'.



Figure 1.6. S4GA Frangible coupling during testing of frangibility in Institute of Research

Frangible coupling for SP-401 airfield lights has been tested in Laborex Research Laboratory. The test confirmed that the yield point separates from the mounting system at 306 J – which is compliant with ICAO requirements.

Table 1.4. Compliance of SP-401 lights with ICAO frangibility requirements

Document	Clause/Figure /Appendix	Requirements	S4GA Specification	Test Verification Report	S4GA Compliance
Aerodrome Design Manual, Doc 9157, Part 6 Frangibility	Clause 4.9.25	The yield point should withstand a bending moment of 204 J without failure but should separate cleanly from the mounting system before the bending moment reaches 678 J	Yield point separates from the mounting system at 306 J	Institute of Research and Certification (Poland) Accredited: Yes Date of report: 27.02.2020 Number of report: LL/075/2020	MEETS
Annex 14, Volume I, 7th Edition	Clause 5.3.1.3	Light fixtures and supporting structures Note – See 9.9 for information regarding siting of equipment and installations on operational areas, and the Aerodrome Design Manual (Doc 9157), Part 6, for guidance on frangibility of light fixtures and supporting structures.	Frangible yield point of mounting for SP-401 Airfield Light separates from the mounting system at 306 J	Institute of Research and Certification (Poland) Accredited: Yes Date of report: 27.02.2020 Number of report: LL/075/2020	MEETS

Table 1.5. Compliance of SP-401 lights with FAA frangibility requirements

Document	Clause/Figure /Appendix	Requirements	S4GA Specification	Test Verification Report	S4GA Compliance
FAA AC 150-5345-46E Specification For Runway And Taxiway Light Fixtures	Clause 3.4.2.1	Yield Device. a. Each elevated light fixture must have a yield point near the point or position where it attaches to the base plate or mounting stake. (1) The yield point must be no more than 1.5 inches (38 mm) above the threaded interface of the elevated light cover (see AC 150/5345-42 for more information). See AC 150/5340-30 for additional information about light fixture yield point above grade location. (2) The yield point must give way before any other part of the fixture is damaged, and must withstand a bending moment of 150 foot-pounds (203 Newton-meters (N-m) without failure. (3) The yield point must cleanly separate from the mounting system before the bending moment reaches 500 foot-pounds (678 N-m). (4) If the yield device uses a threaded connection to the base plate or stake, it should have a male external thread with either 2 inch (50.80 mm)-11.5 National Pipe Thread (NPT) or National Pipe Straight (NPS) thread, or 1.5 inch (38.10 mm)-12 Unified Fine (UNF) thread.	SP-401 elevated light is fully compliant with FAA frangibility requirements	Institute of Research and Certification (Poland) Accredited: Yes Date of report: 27.02.2020 Number of report: LL/075/2020	MEETS
FAA AC 150 5220-23 Frangible Connections	Clause 3.2	[Short version] Equipment located in airfield safety areas must be mounted on frangible supports to ensure the structure will break, distort, or yield in the event of an accidental impact by an aircraft.	SP-401 light is equipped with frangible mounting	Institute of Research and Certification (Poland) Accredited: Yes Date of report: 27.02.2020 Number of report: LL/075/2020	MEETS

Secondary Power Supply Compliance

Traditional airfield lighting system is powered by 6.6A electrical circuit. The circuit is energized by a single power source. In ICAO documents this source is called primary power supply. In some cases, airport can lose primary power supply (failure at city power plant, substation fire, loss of constant current regulators, cable damage).

As a result, airfield lighting stops working and airport becomes partially or completely unavailable for flight operations.

In order to prevent such situation, airport should have a backup – or secondary – power supply. ICAO regulates secondary power supply, and provides requirements in ICAO Annex 14 Volume I. According to ICAO, secondary power supply should be either an independent power source able to be connected to the primary airfield lighting system via cables; or standby power units such as generators or batteries.

SP-401 lighting unit is compliant with ICAO norms. It is equipped with two independent built-in batteries. Battery #1 is used as the primary power source for SP-401 light. Battery #2 is used when the primary battery is discharged or unavailable. Switch-over time is 0 sec.



Figure 1.7. Power bank integrated into SP-401 Airfield Light

Table 1.6. Compliance of SP-401 lights with ICAO Annex 14 requirements on secondary power supply

Clause/Figure /Appendix	Requirements	S4GA Specification	S4GA Compliance
Clause 8.1.8-8.1.9	Recommendation. – At an aerodrome where the primary runway is a non-precision approach runway, a secondary power supply capable of meeting the requirements of Table 8-1 should be provided except that a secondary power supply for visual aids need not be provided for more than one non-precision approach runway. Recommendation. – At an aerodrome where the primary runway is a non-instrument runway, a secondary power supply capable of meeting the requirements of 8.1.4 should be provided, except that a secondary power supply for visual aids need not be provided when an emergency lighting system in accordance with the specification of 5.3.2 is provided and capable of being deployed in 15 minutes.	SP-401 light is equipped with 2 x batteries. One battery is used as primary power source. The second battery is used as backup power source. In case of failure switchover time to secondary power source is less than 1 sec.	MEETS
Clause 8.1.11	Recommendation. – Requirements for a secondary power supply should be met by either of the following: – independent public power, which is a source of power supplying the aerodrome service from a substation other than the normal substation through a transmission line following a route different from the normal power supply route and such that the possibility of a simultaneous failure of the normal and independent public power supplies is extremely remote; or – standby power unit(s), which are engine generators, batteries, etc., from which electric power can be obtained	SP-401 light is equipped with 2 x batteries. One battery is used as primary power source. The second battery is used as backup power source. Batteries, lead acid type	MEETS

Electromagnetic Compatibility Compliance

Electromagnetic compatibility (EMC) is the ability of electronic equipment to function acceptably in electromagnetic environment and not to interfere other electronic devices located in the same environment. In simple words, if the elements of airfield lighting system communicate with each other via wireless network, they should not interfere with other airport systems such as ILS, VOR, DME. Electromagnetic compatibility is regulated by the European Parliament and the Council documents:

- RED DIRECTIVE 2014/53/EU on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC
- ROHS DIRECTIVE 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

S4GA equipment has been tested on electromagnetic compatibility at Military Institute of Armament Technology. SP-401 lights as well as other electronic equipment successfully passed the tests.



Figure 1.8. SP-401 Airfield Light during EMC testing in Military Institute of Armament Technology

Table 1.7. Compliance of SP-401 lights with RED Directive Requirements

Document	Clause/Figure/Appendix	Requirements	Test Verification Report	S4GA Compliance
RED DIRECTIVE 2014/53/EU on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC	Clause 3.1a	PN-EN 60950-1:2007 +A11:2009 +A1:2011 +A12:2011 +A2:2014 [EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011 +A2:2013, IDT] PN-EN 62311:2010 [EN 62311:2008, IDT] PN-EN 62479:2011 [EN 62479:2010, IDT]	Military Institute of Armament Technology Accredited: Yes Date of report: Report 1: 23.12.2019 Report 2: 11.03.2020 Number of report: Report 1: 34/2019 Report 2: 18/2019	MEETS
	Clause 3.1b	PN-ETSI EN 301 489-1 V2.1.1:2017 [ETSI EN 301 489-1 V2.1.1:2017, IDT] PN-ETSI EN 301 489-3 V2.1.1:2019 [ETSI EN 301 489-3 V2.1.1:2019, IDT] PN-EN 61000-6-1:2019 [EN 61000-6-1:2019, IEC 61000-6-1:2016, IDT] PN-EN 61000-6-3:2008 +A1:2012 [EN 61000-6-3:2007 +A1:2011, IEC 61000-6-3:2006 +AMD1:2010, IDT]; PN-EN 55032:2015 [EN 55032:2015, CISPR 32:2015, IDT]; PN-EN IEC 61000-3-2:2019 [EN IEC 61000-3-2:2019, IEC 61000-3-2:2018, IDT]; PN-EN 61000-3-3:2013 +A1:2019 [EN 61000-3-3:2013 +A1:2019, IEC 61000-3-3:2013 +AMD1:2017, IDT]; PN-EN 61000-4-2:2011 [EN 61000-4-2:2009, IDT]; PN-EN 61000-4-3:2007 +A1:2008 +IS1:2009 +A2:2011 [EN 61000-4-3:2006 +A1:2008 +IS1:2009 +A2:2010, IEC 61000-4-3:2006, IDT] PN-EN 61000-4-4:2013 [EN 61000-4-4:2012, IEC 61000-4-4:2012, IDT] PN-EN 61000-4-5:2014 +A1:2018 [EN 61000-4-5:2014 +A1:2017, IEC 61000-4-5:2014 +AMD1:2017, IDT]; PN-EN 61000-4-6:2014 [EN 61000-4-6:2014, IEC 61000-4-6:2014, IDT]; PN-EN 61000-4-8:2010 [PN-EN 61000-4-8:2010, IDT] PN-EN 61000-4-11:2007 +A1:2017 [EN 61000-4-11:2004 +A1:2017, IEC 61000-4-11:2004/AMD1:2017, IDT]	Military Institute of Armament Technology Accredited: Yes Report 1: 34/2019 Report 2: 18/2019	MEETS
	Clause 3.2	PN-ETSI EN 300 220-1 V3.1.1:2017 [ETSI EN 300 220-1 V3.1.1:2017, IDT] PN-ETSI EN 300 220-2 V3.2.1:2018 [ETSI EN 300 220-2 V3.1.1:2018, IDT]	Military Institute of Armament Technology Accredited: Yes Report 1: 34/2019 Report 2: 18/2019	MEETS
	Clause 3.1a	PN-EN 60950-1:2007 +A11:2009 +A1:2011 +A12:2011 +A2:2014 [EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011 +A2:2013, IDT] PN-EN 62311:2010 [EN 62311:2008, IDT] PN-EN 62479:2011 [EN 62479:2010, IDT]	Military Institute of Armament Technology Accredited: Yes Report 1: 34/2019 Report 2: 18/2019	MEETS

Table 1.8. Compliance of SP-401 lights with RoHS Requirements

Document	Clause/Figure/Appendix	Requirements	Test Verification Report	S4GA Compliance
ROHS DIRECTIVE 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment	Clause 4.1	PN-EN 50581:2013 [EN 50581:2012, IDT]	Military Institute of Armament Technology Accredited: Yes Date of report: Report 1: 23.12.2019 Report 2: 11.03.2020 Number of report: Report 1: 34/2019 Report 2: 18/2019	MEETS

Compliance with FAA

Unlike the previous three institutions, FAA is not a military-dedicated body. It regulates both civil and military markets. However, because almost all national Air Force Departments follow FAA regulations, S4GA has to be compliant with FAA norms accordingly.

Requirements to military airfield lighting equipment are described in **FAA AC 150/5345-50B Specification for portable runway and taxiway lights**. The norms are related to photometric, power source, environmental conditions, and remote control of airfield lights. SP-401 airfield lights are fully compliant with AC 150/5345-50B and meet or exceed its requirements.

Table 1.9 Compliance of SP-401 Lights with FAA AC 150/5345-50B

Paragraph/ Annex	Norm	Requirement	S4GA Specification	S4GA Compliance
3.3 Photometric Requirements, Table 1	Photometric requirements	L-863 White, omni-directional: 20 cd L-863 Yellow, omni-directional: 6.2 cd L-863 Green omni-directional: 6.2 cd L-863 Red omni-directional: 1.8 cd L-863 Blue omni-directional: 1.4 cd	SP-401 white, omni, min, 70 cd + directional: 1200 cd SP-401 yellow, omni: 50 cd + directional: 1200 cd SP-401 green, directional: 450 cd SP-401 red, directional: 320 cd SP-401 TWY, blue: 2cd	EXCEEDS
3.4.2.2 Solar Charged Batteries	Solar Charging	Solar charged batteries must be of a type that allows for a minimum equivalent peak of 3 sun hours to maintain operation at full intensity level	Rapid Charging Technology: Yes 1 hr solar charging provides 5 hrs of operations	EXCEEDS
3.4.2.1 Battery Operation after Recharge, a.	Battery Autonomy	Battery autonomy: min 12 hrs	Battery Autonomy: 200 hrs (rwy edge light at minim intensity)	EXCEEDS
3.4.2.1 Battery Operation after Recharge, b.	Battery life span	Charge/discharge cycles: 125	Charge/discharge cycles: 1200	EXCEEDS
3.4.3 Lamp.	Lamp life span	Rated life: 1500 hrs	Rated life: 100.000 hrs	EXCEEDS
3.7 Radio Control.	remote activation of the lights	A remote radio control: option	Remote radio control: Yes	MEETS
3.7 Radio Control.	air-to-ground control	PPT activation of the lights: option	PPT activation of the lights: option	MEETS
4.3.3 Wind Test.	Jet Blast Resistance	light units will remain in place and not be damaged when blown over by the wind speed 240 kph	SP-401 unit tested for jet blast resistance of max wind 240 kph	MEETS
4.3.4 Low Temperature Test.	Operating temperature	Unit shall be able to operate at -20 deg. Celsius	SP-401 Light can operate within -20 to +50 deg. Celsius	MEETS
4.3.5 High Temperature Test.	Operating temperature	Unit shall be able to operate at +50 deg. Celsius	SP-401 Light can operate within -20 to +50 deg. Celsius	MEETS
4.3.6 Rain Test	Ingress Protection	Unit shall be able to withstand rain 13cm/hr for 30 minutes	SP-401 Light rating is IP67 (can be submerged in water for 30 minutes)	EXCEEDS
4.3.10 Weight.	Weight	The complete lighting unit must not exceed 16 kg	SP-401 Lighting Unit weight is 5 kg	EXCEEDS

Compliance with NATO

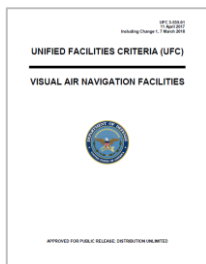


NATO's requirements to airfield lighting equipment are given and described in **STANAG 3534 Airfield Lighting, Marking and Tone Down Systems for Non-Permanent / Deployed Operations**. The document includes requirements related to portable airfield lights – photometric norms, battery and autonomy, AGL control. S4GA portable airfield lights meet or exceed requirements given in STANAG 3534.

Table 1.10. Compliance of SP-401 Lights with NATO STANAG 3534

Paragraph/Annex	Norm	Requirement	S4GA Specification	S4GA Compliance
Annex O - Summary of portable airfield lighting types	Photometrical output - Type 1 Basic VFR Night Met VIS>7KM	rwly edge, omni-directional, 15 cd NVG capable: Yes, Battery operated: Yes Solar-powered: Possibly VHF Control: Yes	omnidirectional: 50 cd, bidirectional 1200 cd NVG capable: Yes, Battery operated: Yes Solar-powered: Yes (rapid charging) VHF Control: Yes Individual Light Monitoring: Yes	EXCEEDS
	Photometrical output - Type 2A (Basic VFR system) Night Met VIS>3,7KM	rwly edge, omni-directional, 50 cd NVG capable: Yes, Battery operated: Yes Solar-powered: Possibly A-PAPI powered by APU: Yes VHF Control: Yes	omnidirectional: 50 cd, bidirectional 1200 cd NVG capable: Yes, Battery operated: Yes Solar-powered: Yes (Rapid Charging) A-PAPI powered by APU: Yes VHF Control: Yes Individual Light Monitoring: Yes	EXCEEDS
	Photometrical output - Type 2b (Instrument Approach) Night Met VIS>0,8KM	Approach lights: 250 cd	SP-401 Approach: 250 cd	MEETS
	Photometrical output - Type 3 (Cabled IFR system) Day/Night Met VIS>0,4KM	rwly edge, directional: 5000 cd approach: directional, 5000 cd Brilliance control required: Yes	SP-401 HIRL directional: 10000 cd SP-401 HIRL directional, 10000 cd Brilliance control required: Yes Powered by: 230 VAC cable Backup battery: Yes Solar-powered: Yes (optional)	EXCEEDS
Part A, pt. 11 - Operating Criteria for minimum airstrips	Optimum installation time	optimal 60 min	S4GA rwly lighting installation: 20 min	EXCEEDS
	Typical Operation period	min 8 hours	SP-401 Runway Edge Light Autonomy: 200 hrs (15 days)	EXCEEDS

Compliance with USDOD



USDOD provides photometric requirements to airfield lighting fixtures in **UFC 3-535-01 Visual Air Navigation Facilities**. SP-401 portable airfield lights are fully compliant with this document.

Table 1.11. Compliance of SP-401 Lights with UFC 3-535-01

Paragraph / Annex	Norm	Requirements	S4GA specification	S4GA Compliance
Chapter 11. Portable Emergency Lighting. Clause 11-5 Fixtures	Optics	Fixtures may be omnidirectional, bidirectional, unidirectional	SP-401 light optics: omnidirectional: yes unidirectional: yes bidirectional: yes	MEETS
	Photometric	Unidirectional and bidirectional fixtures meeting FAA AC 150/5345-50 may be used	SP-401 light exceeds requirements of FAA AC 150/5354-50	EXCEEDS

Compliance with AFCEC



Air Force Civil Engineer Center provides requirements to solar-powered airfield lighting in **ETL 11-27 Solar Lighting For Airfields**. The requirements are quite general. S4GA solar airfield lighting fully meets ETL norms.

Table 1.12. Compliance of SP-401 Lights with ETL 11-27

Paragraph / Annex	Norm	Requirements	S4GA specification	S4GA Compliance
Policy, 6.1	Solar-powered lights	Solar-powered fixtures are approved for use in expeditionary locations, ranges, and areas used only for training for the following applications: • Runway edge lights • Threshold lights • Taxiway edge lights • Obstruction lights	SP-401 Solar Runway Light is offered in following models: - runway edge light - threshold light - taxiway light - obstruction light	MEETS
Policy, 6.2	Photometric compliance	Runway/taxiway fixtures shall conform to the minimum intensity requirements in FAA AC 150/5345-50, Specification for Portable Runway and Taxiway Lights, Table 1, "Photometric Requirements."	SP-401 light exceeds requirements of FAA AC 150/5354-50	EXCEEDS

CHAPTER 2. Compliance of S4GA ALCMS - Airfield Lighting Control and Monitoring System

For control and monitoring of airfield lighting system, S4GA offers ALCMS. It provides full control and individual light status monitoring of S4GA airfield lights.

ALCMS consists of two main components. UR-201 Control & monitoring Unit is a hardware; Computer interface is a software of S4GA ALCMS. Additionally, a Handheld Controller can be used for remote activation of S4GA systems.

There are few documents that regulate different aspects of AGL control systems.

Requirements to software are regulated by ICAO and FAA and given in the following documents:

- ICAO Aerodrome Design Manual, Doc 9157, Part 5 Electrical Systems
- ICAO Annex 14, Volume I, Chapter 8 Electrical Systems
- FAA AC 150/5345-56B, Specification for L-890 Airport Lighting Control and Monitoring System (ALCMS).

Requirements to hardware are regulated by FAA and European Parliament and the Council in the following documents:

- FAA AC 150/5345-56B
- RED DIRECTIVE 2014/53/EU
- ROHS DIRECTIVE 2011/65/EU

S4GA ALCMS is compliant with all norms and regulations given in the above documents. Software and hardware equipment has been tested and certified accordingly. Test reports and certificates are available on request



Figure 2.1. S4GA Computer interface (software of S4GA ALCMS)



Figure 2.2. UR-201 Control & Monitoring Unit (hardware of S4GA ALCMS)

Compliance of ALCMS Software

Table 2.1. Compliance of S4GA ALCMS Computer Interface with ICAO Aerodrome Design Manual

Norm	Clause/Figure /Appendix	Requirements	S4GA Specification	S4GA Compliance
Part 5 Electrical Systems / Chapter 10	Control & Monitoring of Aerodrome Lighting Systems	10.1 Apron Control Panel - separate control system for Apron lights	S4GA ALCMS can be configured in various configurations allowing for MASTER-SLAVE or MASTER/MASTER simultaneous operations from various locations (not necessary to be interconnected but optionally can be configured)	MEETS
		10.2 Control Circuitry - selective control of multiple circuits	S4GA ALCMS can control individual groups (circuits) of lights from 1x to 10.000 x lights in a group (circuit)	MEETS
		10.3 Types of remote control systems - manual & computerized types of remote control system	S4GA ALCMS operates computerized control system based on radio communication (not cable) for Control	MEETS
		10.4 Transfer relay panel - only one station in control (in case of multiple work stations set-up)	S4GA ALCMS has incorporated button in the layout	MEETS
		10.5 Use of relays - relay panels used in case control circuit being long	S4GA ALCMS system use S4GA relays for control of remote power sources	MEETS

		10.6 Interconnection of controls - grouping of circuits for functionality	S4GA ALCMS allows for grouping	MEETS
		10.7 Automatic controls - automatization of circuit activation under certain conditions	S4GA ALCMS has automatic Dusk till down mode for all controlled groups	MEETS
		10.8 Addressable lights - light fixtures are controlled individually	S4GA ALCMS has built in as standard individual light control	MEETS
		10.9 Response time - change of operational status when control signal is sent	S4GA ALCMS has response time of max. 2 seconds	MEETS
		10.10 Monitoring aerodrome lightning circuits - monitoring various fault conditions	S4GA ALCMS has built in as standard alarm messaging informing about lights/circuits faults	EXCEEDS
		10.11 Classes of monitors - passive or active monitor type	S4GA ALCMS has built capability for Active and Passive monitor types	MEETS
		10.12 Monitor override control - resetting control to maintain system operating level	S4GA ALCMS allows for Manual override of automatic condition	MEETS
		10.14 ARCAL - activation of circuits by radio signal from aircraft	S4GA ALCMS is equipped with Air to ground activation (VHF or GSM)	EXCEEDS

Table 2.2. Compliance of S4GA ALCMS Computer Interface with ICAO Annex 14, Volume I

Norm	Clause/Figure /Appendix	Requirements	S4GA Specification	S4GA Compliance
Electrical Systems Chapter 8	Part 8.3	8.3.1 Recommendation.— A system of monitoring should be employed to indicate the operational status of the lighting systems.	S4GA ACLMS serves that purpose	MEETS
		8.3.2 Where lighting systems are used for aircraft control purposes, such systems shall be monitored automatically so as to provide an indication of any fault which may affect the control functions. This information shall be automatically relayed to the air traffic services unit.	S4GA ALCMS has built in as standard alarm messaging informing about lights/circuits faults	MEETS
		8.3.3 Recommendation.— Where a change in the operational status of lights has occurred, an indication should be provided within two seconds for a stop bar at a runway-holding position and within five seconds for all other types of visual aids.	S4GA ALCMS has response time of max. 2 seconds	MEETS
		8.3.4 Recommendation.— For a runway meant for use in runway visual range conditions less than a value of 550 m, the lighting systems detailed in Table 8-1 should be monitored automatically so as to provide an indication when the serviceability level of any element falls below the minimum serviceability level specified in 10.5.7 to 10.5.11, as appropriate. This information should be automatically relayed to the maintenance crew.	S4GA ALCMS can operate automatically on pre-defined operational conditions	MEETS
		8.3.5 Recommendation.— For a runway meant for use in runway visual range conditions less than a value of 550 m, the lighting systems detailed in Table 8-1 should be monitored automatically to provide an indication when the serviceability level of any element falls below the minimum level specified by the appropriate authority below which operations should not continue. This information should be automatically relayed to the air traffic services unit and displayed in a prominent position.	S4GA ALCMS can relay information automatically on pre-defined operational conditions	MEETS

Table 2.3. Compliance of S4GA ALCMS Computer Interface with FAA AC 150/5345-56B

Norm	Clause/Figure /Appendix	Requirements	S4GA Specification	S4GA Compliance
Specification for L-890 Airport Lighting Control and Monitoring System (ALCMS)	L-890	3. ALCMS General System requirements - split of BASIC and OPTIONAL requirements for ALCMS	S4GA ALCMS follows basic & optional items listed in General System requirements	MEETS
		4. Design requirements - Hardware min. requirements	S4GA ALCMS hardware specs are in line with Design requirements listed (for non-wire infrastructure part)	MEETS
		5. Control Design requirements - Software requirements	S4GA ALCMS hardware specs are in line with Control Design requirements listed (for non-wire infrastructure part)	MEETS
		6. Monitoring requirements (Control Only) - Type B	S4GA ALCMS meets type A requirements	EXCEEDS
		6. Monitoring requirements (Basic Monitoring) - Type B	S4GA ALCMS meets type B requirements	EXCEEDS
		6. Monitoring requirements (Advanced Monitoring) - Type C	S4GA ALCMS meets type C requirements - Partly Compliant	EXCEEDS
		6. Monitoring requirements (SMGCS ready, individual lamps out monitoring) - Type D	S4GA ALCMS meets type C requirements - Partly Compliant	EXCEEDS
		7. FailSafe Design requirements - protection against failure of ALMCS	S4GA ALCMS & system logic meets Type B failsafe	MEETS
		9. Manufacturer Support - access to Manuf. support	S4GA ALCMS has 24/7/365 support available	MEETS

Compliance of ALCMS Hardware

Table 2.4. Compliance of UR-201 Control & monitoring Unit with RED Directive

Document	Clause/Figure /Appendix	Requirements	Test Verification Report	S4GA Compliance
RED DIRECTIVE 2014/53/EU on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC	Clause 3.1a	PN-EN 60950-1:2007 +A11:2009 +A1:2011 +A12:2011 +A2:2014 [EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011 +A2:2013, IDT] PN-EN 62311:2010 [EN 62311:2008, IDT] PN-EN 62479:2011 [EN 62479:2010, IDT]	Military Institute of Armament Technology Accredited: Yes Date of report: Report 1: 23.12.2019 Report 2: 11.03.2020 Number of report: Report 1: 34/2019 Report 2: 18/2019	MEETS
	Clause 3.1b	PN-ETSI EN 301 489-1 V2.1.1:2017 [ETSI EN 301 489-1 V2.1.1:2017, IDT] PN-ETSI EN 301 489-3 V2.1.1:2019 [ETSI EN 301 489-3 V2.1.1:2019, IDT] PN-EN 61000-6-1:2019 [EN 61000-6-1:2019, IEC 61000-6-1:2016, IDT] PN-EN 61000-6-3:2008 +A1:2012 [EN 61000-6-3:2007 +A1:2011, IEC 61000-6-3:2006 +AMD1:2010, IDT] PN-EN 55032:2015 [EN 55032:2015, CISPR 32:2015, IDT] PN-EN IEC 61000-3-2:2019 [EN IEC 61000-3-2:2019, IEC 61000-3-2:2018, IDT] PN-EN 61000-3-3:2013 +A1:2019 [EN 61000-3-3:2013 +A1:2019, IEC 61000-3-3:2013 +AMD1:2017, IDT] PN-EN 61000-4-2:2011 [EN 61000-4-2:2009, IDT] PN-EN 61000-4-3:2007 +A1:2008 +IS1:2009 +A2:2011 [EN 61000-4-3:2006 +A1:2008 +IS1:2009 +A2:2010, IEC 61000-4-3:2006, IDT] PN-EN 61000-4-4:2013 [EN 61000-4-4:2012, IEC 61000-4-4:2012, IDT] PN-EN 61000-4-5:2014 +A1:2018 [EN 61000-4-5:2014 +A1:2017, IEC 61000-4-5:2014 +AMD1:2017, IDT] PN-EN 61000-4-6:2014 [EN 61000-4-6:2014, IEC 61000-4-6:2014, IDT] PN-EN 61000-4-8:2010 [PN-EN 61000-4-8:2010, IDT] PN-EN 61000-4-11:2007 +A1:2017 [EN 61000-4-11:2004 +A1:2017, IEC 61000-4-11:2004/AMD1:2017, IDT]	Military Institute of Armament Technology Accredited: Yes Date of report: Report 1: 23.12.2019 Report 2: 11.03.2020 Number of report: Report 1: 34/2019 Report 2: 18/2019	MEETS

	Clause 3.2	PN-ETSI EN 300 220-1 V3.1.1:2017 [ETSI EN 300 220-1 V3.1.1:2017, IDT] PN-ETSI EN 300 220-2 V3.2.1:2018 [ETSI EN 300 220-2 V3.1.1:2018, IDT]	Military Institute of Armament Technology Accredited: Yes Date of report: Report 1: 23.12.2019 Report 2: 11.03.2020 Number of report: Report 1: 34/2019 Report 2: 18/2019	MEETS
--	------------	--	--	-------

Table 2.5. Compliance of UR-201 Control & monitoring Unit with RoHS Directive

Document	Clause/Figure /Appendix	Requirements	Test Verification Report	S4GA Compliance
ROHS DIRECTIVE 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment	Clause 4.1	PN-EN 50581:2013 [EN 50581:2012, IDT]	Military Institute of Armament Technology Accredited: Yes Date of report: Report 1: 23.12.2019 Report 2: 11.03.2020 Number of report: Report 1: 34/2019 Report 2: 18/2019	MEETS

Table 2.6. Compliance of UR-201 Control & monitoring Unit with FAA AC 150/5345-56B

Clause/Figure/ Appendix	Requirements	S4GA Specification	S4GA Compliance
Par. 4.3 Hardware Requirements	<p>4.3.1 ATC HMI. The ATC HMI must be a touchscreen monitor. The designer must specify the size, resolution and mounting requirements of the monitor. Monitor resolution must be capable of displaying the airport graphics. At a minimum the touchscreen monitor must have the following requirements:</p> <p>a. The monitor must be liquid crystal display (LCD) or equivalent technology with a minimum resolution of 1024 x 768 pixels. CRT monitors are not acceptable.</p> <p>b. Integrated touchscreen technology.</p> <p>c. Non-glare, non-reflective viewing surface.</p> <p>4.3.2 ATC Computer. The ATC Computer associated with the ATC HMI must have the following minimum requirements:</p> <p>a. Capable of being installed a minimum of 500 feet from the ATC HMI. Additional video/communication extension equipment may be required.</p> <p>b. Industrial Grade Computer (IGC) designed for industrial applications. This computer can be a separate component or integrated with the ATC HMI.</p> <p>c. All equipment must be assembled in NEMA 12 enclosures and connected as a complete system. This enclosure must be suitable for the local environment.</p> <p>d. Required communication equipment capable of transmitting the control and status information between the ATC HMI and the other ALCMS computers.</p> <p>e. Power for the ATC Computer must be from a circuit on the tower emergency power panel or by an independent uninterruptible power supply specified by the designer.</p>	<p>Processor - Intel Core i5-9400 (6 cores, from 2.90 GHz to 4.10 GHz, 9 MB cache) Chipset - Intel H370 RAM memory - 16 GB (DDR4 DIMM, 2666 MHz) Graphics card – supporting Full HD technology Intel UHD Graphics 630 M.2 SSD - 256 GB Sound - Integrated sound card Connectivity - Wi-Fi 4 (802.11 b / g / n) , LAN 10/100/1000 Mbps Connectors - USB 3.0 - x2, USB 3.0 - x2, Audio input / output - 3 RJ-45 (LAN) - 1 VGA (D- sub) - 1 HDMI - 1 AC-in (power input) - 1.</p>	EXCEEDS
		<p>Monitor Touch 31.5 inch Elo 3202L Touch Screen Monitor IDS - specs Border color - black Active display area - 698.4 mm (H) x 392.9 mm (V) or 27.49 inches (H) x 15.47 inches (V) Dimensions - IR model : 762.8 mm (length) X 457.3 mm (height) X 61.6 mm (depth) Or 30.03 inches (height) X 18.00 inches (height) X 2.43 inches (D.) LCD technology - TFT LCD active matrix Mounting options - VESA MOUNT PER MIS-F, 400,400,6MM Input / output ports - Input : power input, USB type B (on touch), VGA, 2x HDMI, GPIO, DisplayPort , Audio Line in Outputs : Audio headphone output, RJ45 (for optional OSD remote control) Resolution - 1920x1080 at 60Hz Aspect ratio - 16: 9</p>	EXCEEDS
		<p>Workstation UPS: Power Walker LINE-INTERACTIVE (1500VA 1350W 8xIEC AVR Rack) - specs Topology - Line-Interactive Apparent power - 1500 VA Effective power - 1350W Input voltage - 0 - 300 V Output voltage shape - Sinusoidal Output sockets - IEC - 8 RJ-11 (in / out) RJ-45 (in / out) Switching time - 2 - 6 ms Average charging time - 4 hours Communication interface - RS232 , USB Work signaling - LCD display , LED diodes Enclosure type - Tower , Rack Additional information - Automatic Voltage Regulation (AVR) , Function Emergency Power Off EPO (Emergency Power Off)</p>	EXCEEDS

Summary

For military airfields and air bases, S4GA offers complete airfield lighting solutions for permanent and mobile applications. S4GA products are designed for and can withstand extreme operating conditions. High quality and high reliability of airfield lights has been proven by multiple product onsite testing and testing in independent accredited laboratories such as Intertek, Military Institute of Armament Technology, Warsaw Institute of Aviation. The products have been tested on photometric & chromaticity, frangibility, jet blast resistance, ingress protection, EMC.

Our airfield lights are compliant with international and regional military standards:

- ICAO Annex 14, Aerodrome Design Manual
- FAA AC 150-5345-46E, AC 150 5220-23, AC 150/5345-50B, AC 150/5345-56B
- NATO STANAG 3534
- USDOD UFC 3-535-01
- AFCEC ETL 11-27
- RED DIRECTIVE 2014/53/EU, RoHS DIRECTIVE 2011/65/EU.

S4GA products are used today by national air forces in Europe, Africa, Latin America and Asia. The Company holds product certificates, CAA approvals, testing reports and other documents which are available on request.

International Aviation Documents

1. ICAO Annex 14, Volume I, 7th Edition dated July 2016
2. ICAO Aerodrome Design Manual, Doc 9157
3. FAA AC 150-5345-46E Specification For Runway And Taxiway Light Fixtures
4. FAA AC 150 5220-23 Frangible Connections
5. FAA AC 150/5345-50B Specification for portable runway and taxiway lights
6. FAA AC 150/5345-56B, Specification for L-890 Airport Lighting Control and Monitoring System (ALCMS)
7. NATO STANAG 3534 Airfield Lighting, Marking and Tone Down Systems for Non-Permanent / Deployed Operations
8. USDOD UFC 3-535-01 Visual Air Navigation Facilities
9. AFCEC ETL 11-27 Solar Lighting For Airfields
10. RED DIRECTIVE 2014/53/EU on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC
11. RoHS DIRECTIVE 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment



WORLD'S SAFEST RUNWAY LIGHTING

Solutions4ga sp. z o. o.
01-476 Sylwestra Kaliskiego 57
Warsaw, Poland

www.solutions4ga.com
+48 22 307 10 01 | office@solutions4ga.com