

COMPLIANCE

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



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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 centres are located in Poland.

S4GA is **ISO 9001:2015 certified** Company. We offer AGL solutions for all types of airports – from huge international hubs to small local airstrips. The Company also serves remote helipads and temporary landing zones.

The Company offers the following types of airfield lighting systems:

- Solar permanent airfield lighting
- Portable emergency runway lighting
- Helipad lighting.

As at 2020, S4GA has delivered over 125 projects in 50 different countries on all continents. We have installed our systems in Latin America, Africa, Europe and Southeast Asia. We delivered permanent, backup and emergency runway lighting. Our systems are used by military and civilian airports of all sizes.

All S4GA airfield lighting products are compliant with international 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 and other international aviation 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

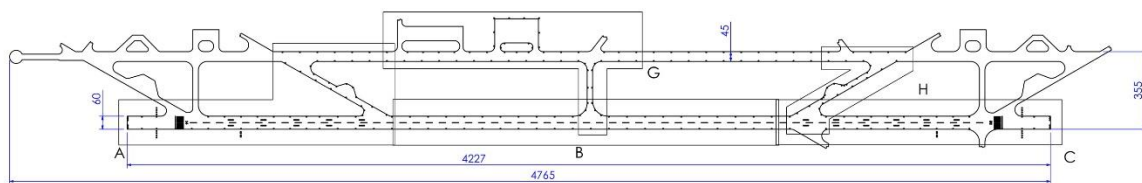


Figure 1.2. Airfield lighting layout with SP-401 Lighting Units

SP-401 lighting unit goes in two versions: portable and solar. Portable version of the light is applicable for temporary usage; 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.

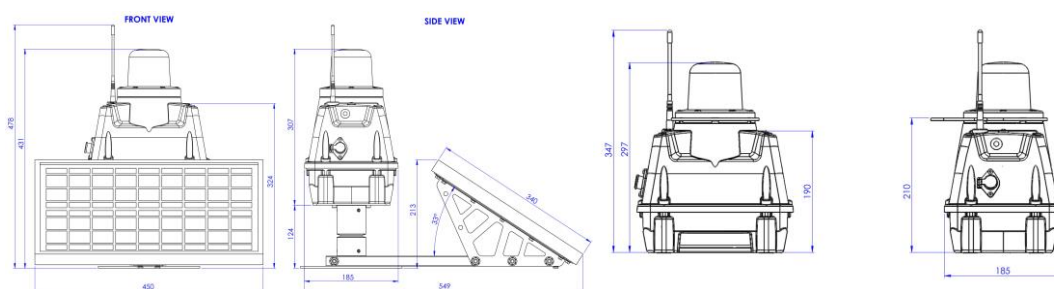


Figure 1.3. Technical drawings of SP-401 Solar and Portable Airfield Lights

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

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

Table 1.1. Compliance of SP-401 lights with ICAO Annex 14 and EASA CS ADR-DSN photometric requirements

ICAO Clause/Figure/Appendix	EASA Clause/Figure/Appendix	Requirements	S4GA Specification	Test Verification Report	S4GA Compliance
ICAO Annex 14 Clause 5.3.4.8 & 5.3.4.9	CS ADR-DSN.M.626 Simple approach lighting systems, point f, g	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
ICAO Annex 14 Clause 5.3.8.3 & 5.3.8.4	CS ADR-DSN.M.670 Runway threshold identification lights, point c-1, c-2	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
ICAO Annex 14 Clause 5.3.9.8 & 5.3.9.9	CS ADR-DSN.M.675 Runway edge lights, points c-2, d	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
ICAO Annex 14 Clause 5.3.9.10	CS ADR-DSN.M.675 Runway edge lights, point e CS ADR-DSN.U.940 Aeronautical ground light characteristics,, Figure U-13, Figure U-14	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
ICAO Annex 14 Clause 5.3.10.9	CS ADR-DSN.M.680 Runway threshold and wing bar lights, point e-1	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
ICAO Annex 14 Clause 5.3.10.10	CS ADR-DSN.M.680 Runway threshold and wing bar lights, point e-2 CS ADR-DSN.U.940 Aeronautical ground light characteristics, Figure U-7	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
ICAO Annex 14 Clause 5.3.11.4	CS ADR-DSN.M.685 Runway end lights, point c-1	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
ICAO Annex 14 Clause 5.3.11.5	CS ADR-DSN.M.685 Runway end lights, point c-2 CS ADR-DSN.U.940 Aeronautical ground light characteristics, Figure U-12	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
ICAO Annex 14 Clause 5.3.18.7 & 5.3.18.8	CS ADR-DSN.M.720 Taxiway edge lights, points c-1, c-2, c-3	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
ICAO Annex 14 Clause 5.3.1.11	CS ADR-DSN.M.615 General, point 3	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 and EASA CS ADR-DSN chromaticity requirements

ICAO Clause/Figure/Appendix	EASA Clause/Figure/Appendix	Requirements	S4GA Specification	Test Verification Report	S4GA Compliance
ICAO Annex 14 Appendix 1, Figure A1-1b	CS ADR-DSN.U.930 Colours for aeronautical ground lights Figure U-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

kilometers 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 of ICAO and FAA

Authority	Document	Clause/Figure/App endix	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
- EASA GM1 ADR-DSN.T.910 Equipment frangibility requirements
- 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 and Certification

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 and EASA 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: 19.03.2021 Number of report: LL/039/2021	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: 19.03.2021 Number of report: LL/039/2021	MEETS
GM1 ADR-DSN.T.910 Equipment frangibility requirements	Not applicable	(a) Equipment and supports required to be frangible should be designed and constructed so that they should break, distort, or yield in the event that they are accidentally impacted by an aircraft [...] (b) Frangible structures should be designed to withstand the static and operational wind or jet blast loads with a suitable factor of safety but should break, distort, or yield readily when subjected to the sudden collision forces of a 3 000 kg aircraft airborne and travelling at 140 km/h (75 kt), or moving on the ground at 50 km/h (27 kt) (c) Guidance on design for frangibility is contained in ICAO Doc 9157, Aerodrome Design Manual, Part 6, Frangibility.	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: 19.03.2021 Number of report: LL/039/2021	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: 19.03.2021 Number of report: LL/039/2021	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: 19.03.2021 Number of report: LL/039/2021	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 and EASA CS ADR-DSN requirements on secondary power supply

ICAO, Annex 14 Clause/Figure/Appendix	EASA Clause/Figure/Appendix	Requirements	S4GA Specification	S4GA Compliance
Clause 8.1.8-8.1.9	CS ADR-DSN.S.880 Electrical power supply systems, point a, c	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	GM1 ADR-DSN.S.880 Electrical power supply, points c-1, c-2	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

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

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 V3.1.1:2018 [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/App endix	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

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



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

- 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 1.2. 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 dawn 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 and EASA CS ADR-DSN.S.890

Document	Requirements	S4GA Specification	S4GA Compliance
CS ADR-DSN.S.890 Monitoring	(a) A system of monitoring should be employed to indicate the operational status of the lighting systems.	S4GA ALCMS allows for individual light monitoring (presents up to 16x operational parameters of each light)	MEETS
	(b) Where lighting systems are used for aircraft control purposes, such systems should be monitored automatically so as to provide an indication of any fault which may affect the control functions. This information should be automatically relayed to the air traffic service unit.	S4GA ALCMS provides automatic light failure notification to air traffic controller	MEETS
	(d) For a runway meant for use in runway visual range conditions less than a value of 550 m, the lighting systems detailed in Table S-1 should be monitored automatically so as to provide an indication when the serviceability level of any element falls below a minimum serviceability level specified in CS ADR-DSN.S.895(c) to (g). This information should be automatically relayed to the maintenance crew.	S4GA ALCMS provides automatic light failure notification as well as triggers pre-defined serviceability notifications. Critical notifications are immediately transferred to maintenance team via ALCMS main screen and and/or via email	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]	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

		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]		
	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	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: 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. b. Integrated touchscreen technology. c. Non-glare, non-reflective viewing surface. 4.3.2 ATC Computer. The ATC Computer associated with the ATC HMI must have the following minimum requirements: a. Capable of being installed a minimum of 500 feet from the ATC HMI. Additional video/communication extension equipment may be required. b. Industrial Grade Computer (IGC) designed for industrial applications. This computer can be a separate component or integrated with the ATC HMI. 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. d. Required communication equipment capable of transmitting the control and status information between the ATC HMI and the other ALCMS computers. 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.	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 FullHD 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.	EXCEEDS
		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	EXCEEDS
		Workstation UPS. PowerWalker 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)	EXCEEDS

CHAPTER 3. Compliance of S4GA Solar Light and Control System with FAA requirements

Compliance of S4GA Light with FAA requirements

Table 3.1. Compliance of SP-401 Solar Light FAA 150/5345-50B Specification for portable runway and taxiway lights

Clause No.	Clause Name	Requirements	S4GA Specification	Verification Document	S4GA Compliance
Clause 3.2.1	Temperature	Exposure to any temperature from -4°F to +122°F (-20°C to +50°C).	Temperature range: -20 to 50 °C (-4 to 122 °F) Optional: -40 to 80 °C (-40 to 176 °F)	SP-401S Runway Light Datasheet	Exceeds
Clause 3.2.2	Wind	Exposure to wind speeds up to 150 mph (240 km/h) from any direction.	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
Clause 3.2.3	Salt Spray (If metallic materials are used).	Exposure to a salt-laden atmosphere.	Mounting is made of marine grade stainless steel (type 316)	Material Data Sheet manufacturer: ThyssenKrupp Model: Stainless Steel 1.4401	Meets
Clause 3.2.4	Sunshine (If plastic materials are used).	Exposure to solar radiation.	Housing is manufactured by injection molding using UV-resistant Lexan Resin SLX2271T	Material Data Sheet manufacturer: Sabik Model: Resin SLX2271T	Meets
Clause 3.2.5	Weather	Exposure to all normal weather conditions including exposure to blowing dirt and sand (up to 150 mph), rain, snow, ice, sleet, and hail	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
Clause 3.3.1	Photometric Requirements. L-863W, L-863W/Y, L-863R/G, L-863Y, L-863R, L-863G, and L-863B Light Units	The photometric performance of each unit is defined in Table 1.	Please refer to table 1.1 Photometric Compliance	Tested by: Intertek For reference to specific reports please refer to table 1.1	Exceeds
Clause 3.3.1	Photometric Requirements. L-863W, L-863W/Y, L-863R/G, L-863Y, L-863R, L-863G, and L-863B Light Units	c. The light color must be equivalent to the aviation color chromaticity as defined by the International Commission on Illumination (CIE) boundary equations which can be referenced in ICAO Annex 14, Volume 1.	Please refer to table 1.2 Chromaticity Compliance	Tested by: Intertek For reference to specific reports please refer to table 1.2	Exceeds
Clause 3.4.2	Rechargeable Batteries.	Rechargeable batteries must be of a readily available type	2x batteries, independently connected Type: VLRA (A valve regulated lead-acid) Battery description 9Ah, 12V	Standard available worldwide Used in solar runway lighting, UPS	Meets
Clause 3.4.2	Rechargeable Batteries.	that will power the light fixtures on a full charge for a minimum of 12 hours, while maintaining the photometric requirements contained in paragraph 3.3.	Autonomy Level Runway Light Minimum intensity: 180 hrs Maximum intensity: 60 hrs	Laboratory: Intertek Accredited: Yes Date of report: 31.12.2020 Number of reports: 201100613HZH-001R1 201100613HZH-001R1	Exceeds
Clause 3.4.2	Rechargeable Batteries.	Fixtures designed to use rechargeable batteries must be equipped with voltage monitoring to prevent excessive battery depletion.	SP-401 lights are equipped with over- and under-charge protection	SP-401S Runway Light Datasheet	Meets
Clause 3.4.2.1	Battery Operation after Recharge.	a. Following operation for at least 8 hours, the batteries must be capable of being charged sufficiently, within a maximum of 13 hours, to power the fixtures for a minimum of 12 hours.	SP-401 light can be re-charged in 12 hrs and is capable to operate for 180 hrs	Laboratory: Intertek Accredited: Yes Date of report: 31.12.2020 Number of reports: 201100613HZH-001R1 201100613HZH-001R1	Exceeds

Clause 3.4.2.1	Battery Operation after Recharge.	b. The batteries must be able to withstand at least 125 total charge/discharge cycles	VLRA Battery used in SP-401 light is capable to withstand 1200 cycles	Material Data Sheet manufacturer: Wamtechnik Model: Resin SBL 9-12L	Exceeds
Clause 3.4.2.2	Solar Charged Batteries.	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 and 1.5 sun hours in flashing mode.	In 3 hrs SP-401 light will be charged to work for the next 60 hrs in flashing mode SP-401 is equipped with 20W solar panel combined with MPPT technology (maximum power point tracking that increases solar charging rate)	SP-401S Runway Light Datasheet	Exceeds
Clause 3.4.2.2	Solar Charged Batteries.	They must be capable of powering the lighting units for a minimum of 8 hours of operation.	Solar Panel can recharge SP-401 unit to operate for 180 hrs	Laboratory: Intertek Accredited: Yes Date of report: 31.12.2020 Number of reports: 201100613HZH-001R1 201100613HZH-001R1	Exceeds
Clause 3.4.3	Lamp	The lamp used with the L-863W, L-863W/Y, L-863R/G, L-863Y, L-863R, L-863G, and L-863B units must have a rated life of at least 1000 hours.	SP-401 lights use LED as a source of life. Lifespan of LED is 100.000 hrs	SP-401S Runway Light Datasheet	Exceeds
Clause 3.6	Housing	The housing must be fabricated from high-impact plastic, nonferrous metal, or from ferrous metal suitably protected against corrosion.	SP-401 housing is fabricated of LEXAN polycarbonate resin that is non-corrosive	SP-401S Runway Light Datasheet	Meets
Clause 3.6	Housing	...high-impact plastic...	SP-401 lighting unit has been tested and has highest impact rating of IK10	Laboratory: OBAC Laboratories Accredited: Yes Date of report: 12.11.2020 Number of reports: 2/LL/304/2020/A	Exceeds
Clause 4.3.6	Rain Test	A rain test must be conducted in accordance with MIL-STD-810F, Method 506.4, paragraph 4.4.2, Procedure I, with a rain rate of 5.2 inches/hr (13 cm/hr). The test duration must be 30 minutes per side. Any leakage of water into the lamp body or failure of the fixture to operate must be cause for rejection.	SP-401 light has ingress protection rate of IP67	Laboratory: Emag Laboratories Accredited: Yes Date of report: 22.02.2019 Number of reports: 5576-ZLK/2019	Exceeds
Clause 4.3.7	Solar Radiation Test	A sunshine test must be conducted in accordance with MIL-STD-810F, Method 505.4, paragraph 4.4.3, Procedure II for all light fixtures with nonmetallic exterior parts. The material must be subjected to a minimum of 56 cycles. The test unit must operate and perform all specified functions after this test. Any evidence of deterioration or alteration of the light fixture must be cause for rejection. For plastic optical lenses or covers, the photometric performance must be measured after this test.	SP-401 light is made of UV-resistant materials Glass Dome: not resistant to UV Housing: low resistance to UV Stainless steel and aluminum parts: low resistance to UV	Test: Performed Laboratory: S4GA Internal Laboratory Date of report: 10.01.2020 Number of report: AF/10/2020/A	Meets
Clause 4.3.8	Salt Fog Test	If the fixture has external metal components, a salt-fog test must be conducted on the assembled light fixture in accordance with MIL-STD-810F, Method 509.4, paragraph 4.5.2, Procedure. The test duration must be 48 hours exposure and 48 hours drying. Any evidence of damage, rust, pitting, or corrosion (except for sacrificial coatings) must be cause for rejection.	SP-401 light is made of salt resistant materials Glass Dome: non-corrosive Housing: non-corrosive Polycarbonate Stainless steel, grade 316: non-corrosive aluminum: non-corrosive	Test: Performed Laboratory: S4GA Internal Laboratory Date of report: 20.01.2020 Number of report: AF/09/2020/A	Meets
Clause 4.3.10	Weight	The complete lighting unit must not exceed 35 lb (16 kg) per HF-STD-001.	SP-401 unit weight is 14.2kg	SP-401S Runway Light Datasheet	Meets
Clause 4.3.4	Low Temperature Test.	16 hrs (12 hrs standby, 4 hrs operating), in -20 deg. Celsius	SP-401 unit can operate in -40 deg Celsius	Test: Performed Laboratory: S4GA Internal Laboratory Date of report: 5.02.2020 Number of report: AF/11/2020/A	Meets
Clause 4.3.5	High Temperature Test.	16 hrs (12 hrs standby, 4 hrs operating), in +50 deg. Celsius	SP-401 unit can operate in +80 deg Celsius	Test: Performed Laboratory: S4GA Internal Laboratory	Meets

				Date of report: 3.02.2020 Number of report: AF/12/2020/A	
Clause 3.7	Radio Control.	A remote radio control for the portable lights must be offered as an optional feature and may be specified by the consumer at the time of purchase. See AC 150/5345-49, Specification L-854, Radio Control Equipment, for more information about radio remote controls and frequency requirements.	UR-201 Control & Monitoring Unit in combination with ALCMS (airfield lighting control and monitoring unit) provide: - Air-to-ground remote control - Ground-to-Ground remote Control - Individual Light Monitoring	Refer to table "Radio Control Compliance"	Exceeds

Table 3.2. 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: 19.03.2021 Number of report: LL/039/2021	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: 19.03.2021 Number of report: LL/039/2021	MEETS

Table 3.3. Compliance of SP-401 lights with jet blast requirements of FAA

Authority	Document	Clause/Figure/Appendix	Requirements	S4GA Specification	Test Verification Report	S4GA Compliance
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

Table 2.4. 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

CHAPTER 4. Compliance of S4GA Solar Lights and Control System with CASA/MOS requirements

Compliance of S4GA Lights with CASA/MOS requirements

Table 3.1. Compliance of SP-401 Solar Light with Chapter 9 / Division 10 Rwy Lights – Low Intensity Light Fixtures

Clause No.	Clause Name	Requirements	S4GA Specification	Verification Document	S4GA Compliance
Part 139 (Aerodromes) Manual of Standards 2019 Clause 9.52	Characteristics of runway edge lights – non-instrument or non-precision approach runway	(a) are fixed; and (b) are omnidirectional; and (c) show variable white; and (d) if elevated – have light distribution that is uniform for the 360° horizontal projection of the light; and (e) for a lighting system set at low intensity – have: (i) a minimum light intensity in accordance with that shown in Figure 9.75 (1); and (ii) a main beam which projects light between 1° and 7° above the horizontal at: (A) a minimum average intensity of not less than 100 cd	SP-401 Runway Edge Light Light Output Optics : Omni-directional Color: White	Laboratory: TUV Accredited: Yes Date of report: 07.09.2022 Number of report: 53511172/1	EXCEEDS
Part 139 (Aerodromes) Manual of Standards 2019 Clause 9.57	Characteristics of runway threshold lights – non-instrument or non-precision approach runway	Runway threshold lights of low intensity or medium intensity must: (a) be fixed; and (b) be unidirectional; and (c) show green in the direction of approach over not less than 38°, and not more than 180°, of azimuth; and (d) for the green lights – have an average intensity of the main beam that is 1 to 1.5 times the intensity of the runway edge lights; and (e) have a light distribution in the direction of approach that is as close as possible to the light distribution of the runway edge lights; and (f) have a minimum light intensity in accordance with that shown in Table 9.75 (2) and Figures 9.75 (1) and 9.75 (2)	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: 180400427H2H-004	EXCEEDS
Part 139 (Aerodromes) Manual of Standards 2019 Clause 9.62	Characteristics of temporarily displaced threshold lights	Temporarily displaced threshold lights must conform to the following requirements: (a) subject to paragraph (b), an array on each side of the runway must consist of 5 lights; (b) for a runway whose width is 30 m or less – each side array may consist of 3 lights instead of 5; (c) the lights must be spaced 2.5 m apart; (d) for runways with visual circling or circuit operations – the innermost light of each side array may be a fixed, omnidirectional light showing green in all angles of azimuth; (e) the outer 4 or 2 lights, as appropriate, of each side array must be fixed, unidirectional lights showing green in the direction of approach over not less than 38°, and not more than 180°, of azimuth; (f) the light distribution in the direction of approach must be as close as possible to that of the runway edge lights; (g) the light intensity must be as close as possible to 1.5 times that of the runway edge lights but not be less than that of the runway edge lights	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: 180400427H2H-004	EXCEEDS
Part 139 (Aerodromes) Manual of Standards 2019 Clause 9.63	Runway lighting before a displaced threshold	If part of a runway located before a displaced threshold is available for aircraft use, runway edge lights in that part of the runway must: (a) show red in the direction of approach to the displaced threshold, with a light intensity of not less than one-quarter, and not more than one-half, that of the white runway edge lights; and (b) in the opposite direction, show: (i) white; or (ii) for a precision approach runway – yellow as appropriate; or (iii) for runway edge lights, located within a runway starter extension, which otherwise do not	SP-401 Runway Threshold Light Light Output (unidirectional): 450 cd Color: Green SP-401 Runway Edge Light Light Output (directional): 1 200 cd Optics: 1 Unidirectional type	Laboratory: Intertek Accredited: Yes Date of report: 20.08.2018 Number of report: 180400427H2H-004 Laboratory: Intertek Accredited: Yes Date of report: 20.08.2018 Number of report: 180400427H2H-004	EXCEEDS

		constitute part of a declared stopway – blue. Note Examples of when a runway located before a displaced threshold is available for aircraft use include use for take-offs using a runway starter extension, and landings from the opposite direction. (2) For subsection (1), runway edge lights must be: (a) bi-directional light fittings; or (b) separate light fittings installed back to back. (3) If the portion of runway before a displaced threshold is closed to aircraft operations, all the runway lights on the portion must be extinguished	(for extended visibility range) Optics 2: Omni-directional (for circuiting guidance) Color: White		
Part 139 (Aerodromes) Manual of Standards 2019 Clause 9.65	Characteristics of non-instrument and non-precision approach runway end lights	Runway end lights of low intensity or medium intensity must: (a) be fixed; and (b) be unidirectional; and (c) show red in the direction of the runway over not less than 38°, and not more than 180°, of azimuth; and (d) for the red light – have an intensity that is not less than one-quarter, and not more than one-half, that of the runway edge lights; and (e) have a light distribution in the direction of the runway that is as close as possible to that of the runway edge lights; and (f) have a minimum light intensity in accordance with Table 9.75 (2) and Figures 9.75 (1) and 9.75 (2). (2) Low-intensity and medium-intensity runway end lights must be inset lights if: (a) the runway is equipped with high-intensity runway end lights; or (b) a stopway or runway starter extension is provided beyond the declared runway end; or (c) it is not physically possible for elevated lights to be installed. (3) If the runway end coincides with the runway threshold, the following may be used: (a) a bi-directional light fitting; (b) separate light fittings, installed back to back	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
Part 139 (Aerodromes) Manual of Standards 2019 Clause 9.67	Runway turn pad, runway bypass pad and runway starter extension edge lights	(1) Where an aircraft turn pad, runway bypass pad or runway starter extension is provided on a runway that has runway edge lights, the edge of the relevant pad or starter extension must be provided with blue edge lights. (2) For subsection (1), edge lights must be located not less than 0.6 m, and not more than 1.8 m, outside the edge of the relevant pad or starter extension. (3) If the beginning of the splay into a relevant pad or starter extension is more than 10 m from the previous runway edge light, a blue edge light must be located where the pad or extension commences. (4) Relevant pad edge lights must be provided to mark any change of direction along the side of the pad. (5) If a side of the relevant pad is longer than 30 m, equally-spaced blue edge lights must be provided along that side, with spacing not exceeding 30 m. (6) Edge lights required under subsection (1) must have the same characteristics as taxiway edge lights under section 9.93	SP-401 Taxiway Edge Light Color: blue	Laboratory: Intertek Accredited: Yes Date of report: 26.03.2019 Number of report: 180400427HZH-009	EXCEEDS
Part 139 (Aerodromes) Manual of Standards 2019 Clause 9.68	Stopway lights	Runway end lights of low intensity or medium intensity must: (a) be fixed; and (b) be unidirectional; and (c) show red in the direction of the runway over not less than 38°, and not more than 180°, of azimuth; and (d) for the red light – have an intensity that is not less than one-quarter, and not more than one-half, that of the runway edge lights; and (e) have a light distribution in the direction of the runway that is as close as possible to that of the runway edge lights; and (f) have a minimum light intensity in accordance with Table 9.75 (2) and Figures 9.75 (1) and 9.75 (2). (2) Low-intensity and medium-intensity runway end lights must be inset lights if: (a) the runway is equipped with high-intensity runway end lights; or (b) a stopway or runway starter extension is provided beyond the declared runway end; or (c) it is not physically possible for elevated lights to be installed. (3) If the runway end coincides with the runway threshold, the following may be used: (a) a bi-directional light fitting; (b) separate light fittings, installed back to back	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

Summary

S4GA delivers World's Safest Runway Lighting. Safety and reliability are the DNA of S4GA. Every product that we sell, every modification that we implement is done with the same aim – to increase safety of airport flight operations and ensure airport availability 24/7.

Our airfield lighting products are compliant with international aviation standards and requirements issued by global civil aviation institutions:

- ICAO Annex 14
- ICAO Aerodrome Design Manual
- EASA CS ADR-DSN
- CASA Part 139 (Aerodromes) Manual of Standards 2019 (as amended)
- FAA AC 150-5345-46E, AC 150 5220-23, AC 150/5345-50B, AC 150/5345-56B
- RED DIRECTIVE 2014/53/EU
- RoHS DIRECTIVE 2011/65/EU

S4GA products also meet international military standards given in STANAG 3534, UFC 3-535-01, ETL 11-27.

S4GA airfield lighting has passed multiple tests provided by 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.

International Aviation Documents

1. ICAO Annex 14, Volume I, 7th Edition dated July 2016
2. ICAO Aerodrome Design Manual, Doc 9157
3. EASA CS ADR-DSN
4. Part 139 (Aerodromes) Manual of Standards 2019 (as amended)
5. FAA AC 150-5345-46E Specification For Runway And Taxiway Light Fixtures
6. FAA AC 150 5220-23 Frangible Connections
7. FAA AC 150/5345-50B Specification for portable runway and taxiway lights
8. FAA AC 150/5345-56B, Specification for L-890 Airport Lighting Control and Monitoring System (ALCMS)
9. 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
10. RoHS DIRECTIVE 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment



Solutions4ga sp. z o. o.
26-600 Biznesowa 4
Radom, Poland

WORLD'S SAFEST RUNWAY LIGHTING

www.solutions4ga.com
+48 22 270 10 29 | office@solutions4ga.com