

1 Technical Specifications

1.1 High Intensity Elevated Unidirectional Approach Light (white or red)

1.1.1 LED type High Intensity Elevated Unidirectional Approach Light

1.1.1.1 General

1.1.1.1.1 Description

The following section describes all aspects related to the supply of high intensity elevated unidirectional approach lights, in compliance with the specifications.

1.1.1.1.2 Applicable Regulations

The ruling standards for this equipment are:

ICAO: Annex 14, Volume I, para. 5.3.4

ICAO - Aerodrome Design Manual, Part 4 and Part 6

FAA: AC150/5345-46 and E-982 specification for what regards materials, construction performances and testing

FAA - Engineering Brief No 67: Light sources other than incandescent and xenon for airport and obstruction lighting fixtures

1.1.1.2 Equipment

1.1.1.2.1 General Requirements

The lighting fixtures shall be unidirectional, emitting white or red light.

The luminous sources shall be electro-luminescent diodes (LED's).

It shall be possible to install the lights on existing 6.6A series circuits in addition to, or in replacement of, conventional incandescent or halogen lights without having to change any other element (CCR, primary and secondary cabling, series isolating transformer, etc.). Use of transformers of a higher power rating than the light (provided the short-circuit current of the transformer does not exceed 7.2A nominal) shall not result in reduced life time nor in higher light output at full intensity.

The light shall be directly fed from the isolation transformer; separate power converters shall not be accepted.

1.1.1.2.2 Demonstration of Reliability

Keeping in mind the consequences of potential early failures, it is required from the bidder to prove the reliability of the offered lights, using as much as possible of the following proofs:

- List of references of installed lights, including at least five sites featuring an experience of at least four years and 20,000 hours of operation (in case the equipment is recent on the market, the proof can be based on other types of LED lights manufactured by the same supplier).
- Proof and description of long-term in-site testing executed on a platform and demonstrating the capability of the proposed material to withstand environmental conditions encountered on airports: weather, chemicals, heavy traffic, lightning strikes, etc. (the proof can be based on other types of LED lights manufactured by the same supplier).

1.1.1.2.3 Structural Characteristics

Each light shall include the following components or sub-assemblies:

- Central body, made from aluminium alloy, and containing the following elements:
 - slip fitter for installation on 60 mm O.D tube
 - adjustment mechanism
 - main housing, supporting a front and a rear cartridge
 - watertight cable stress reliever
- Hinged and removable front cartridge, aluminium alloy, containing the LEDs and following optical components:
 - Front glass seal
 - Front glass, thermal shock resistant
 - Front glass securing clamp
 - Front cartridge gasket
 - LED assembly and lens
- Hinged and removable rear cartridge, aluminium alloy, containing the main electronic board and a rear cartridge gasket

It shall be possible to open and replace the front and rear cartridge without use of any tool. Use of losable screws is not permitted.

Replacement of the front or the rear cartridge shall not disturb the alignment of the light.

All components shall resist the temperatures encountered during the normal operation of the fixture, at full intensity, under maximum ambient temperature

The supply cable shall run through the central body to the breakable coupling and shall have an FAA L-823 (AC 150/5345-26) style 1, fig.1 (a) plug moulded at one end. Length of the cable shall be no less than 0.5 m (for ground-mounted lights) and it shall be flexible

The assembly shall be sturdy and as small as possible, to present a minimum resistance to the aircraft engine jet blast

The setting of the elevation angle shall be done through two opposite adjustment screws ensuring optimal stability under the vibrations

The hardware shall be plain stainless steel throughout

The design and construction shall be in accordance with the main mechanical and testing requirements of FAA E-982 specification.

The protection degree of the fitting shall be IP 54 or better.

Lighting fixtures with LED technology shall present a MTBF at full intensity (6.6A) of not less than 56,000 hours.

1.1.1.2.4 Electrical Performances

- A galvanic insulation shall provide a protection against voltage surges (lightning strikes)
- Power consumption of the light shall not be higher than 60 VA, with a minimum power factor of 0.9 at 6.6A
- The lights shall work satisfactorily when powered through an isolation transformer complying with FAA AC 150/5345-47 from any type of Constant Current Regulator (CCR) complying with FAA AC 150/5345-10 and IEC 61822
- A measurement of the input current shall be used to determine the current provided to the LED's. The electronic circuit shall then use high frequency pulsewidth modulation (PWM) to generate through the LED's the current needed to provide a light output similar to that of a halogen light
- For thyristors-type CCR's, the current is interrupted by the thyristors during part of the cycles. As long as the load of the CCR is higher than 10% of its nominal value, this shall not cause LED lights to present 100Hz flickering for any current between 2.8 and 6.6A
- The light shall be able to sustain currents up to 8.25A RMS without failure, with a maximum crest factor of 3.2 for limited periods

If required, a possibility shall be offered to monitor a failure of the light. This option shall comply with the following requirements:

- The light shall react in case of failure of one LED, be it in open or in short circuit, as well as in case of a failure of the electronic board to supply the LEDs with current
- The light shall create an open circuit in the secondary loop
- A double check shall be executed to avoid false alarms in case of erroneous detection of a failure
- In normal conditions, the monitoring option shall not increase the power consumption of the light
- In case the monitoring option has worked and the light has gone into open circuit, this situation shall be stable. The reset of the light shall be manual to avoid accidental reset of a failed light

1.1.1.2.5 Photometric Performances

The light fixtures shall emit light into one direction. The light characteristics shall be compliant to the requirements specified in ICAO Annex 14, Vol. I, Appendix 2, fig.A2-1 (white lights) or A2-2 (red lights).

The variation of the light output in function of the input current shall match that of a halogen light. No "steps" in the light output shall be visible when the current is increased progressively. For currents higher than 6.6A, the light output shall remain stable at the same value as at 6.6A. Specifically, it shall comply with FAA Engineering Brief N° 67.

When the current is turned on at any step of the CCR, the light output shall come up within less than 0.5 sec, avoiding the long starting time of halogen bulbs. The required beam colour shall be obtained without use of any colour filter. Colour coordinates for the five points of the primary beam shall comply with ICAO Annex14, Appendix 1, § 2.

1.1.1.3 Mounting

The fixtures shall be installed according to the procedures detailed in the installation manual of the light supplier. The frangibility requirements of Annex 14 and par. 5.3.1.4 and of the Aerodrome Design Manual, Part 6, shall be fully applicable to the three

following mounting methods. Depending on the topography of the approach zone surface, three mounting systems shall be used:

1.1.1.3.1 Ground Mounting

The light shall be mounted on a concrete block having an embedded, 2" conduit elbow or a base plate with 2" coupling secured to a galvanised steel deep base according to the FAA specification L-867B. The light shall be mounted on a breakable coupling having a 2", 11 TPI, threaded portion, to be screwed into the conduit elbow or into the base cover plate and ensuring the lowest possible height above surrounding ground.

1.1.1.3.2 Conduit Column Mounting (up to 1.8m height)

This mounting system consists of an aluminium alloy conduit of 60mm outer diameter and a breakable coupling of 60 mm inner diameter, fitted with multiple screws to adjust the conduit vertically to compensate verticality errors up to 4.5 degrees. The light shall be mounted on a concrete block having an embedded, 2" conduit elbow or a base plate with 2" coupling secured to a galvanised steel deep base according to the FAA specification L-867B. Alternatively, synthetic materials can be used for these poles. In such cases, the foundation block has to be adapted to the mounting requirements of the pole.

1.1.1.3.3 Mounting on Frangible Masts (height above 1.8 m)

The masts shall be designed to support one or several lights. They shall fully comply with the requirements of the FAA specification AC 150/3545-45. They shall be manufactured from anodised aluminium or from synthetic materials. The masts shall be provided at the top with 60mm O.D. supports) for the approach lights. Couplings, screws, nuts and bolts shall be made of stainless steel. All nuts shall be self-locking. The masts shall be completely frangible, or at least their top 12 m in case of higher masts. The weight of the fully frangible part shall not exceed 1.7 kg per linear metre in order to prevent or minimise damage to colliding aircraft.

1.2 High Intensity Elevated Threshold - Threshold Wing Bar and Runway End Lights

1.2.1 LED type High Intensity Elevated Threshold - Threshold Wing Bar and Runway End Light

1.2.1.1 General

1.2.1.1.1 Description

The following specification describes all aspects related to the supply of high intensity elevated unidirectional threshold, threshold wing bar and runway end lights (green or red), in compliance with the specifications. The configuration of the threshold, threshold wing bar and runway end lights shall be compliant with ICAO Annex 14, Volume I, para. 5.3.10 and 5.3.11.

1.2.1.1.2 Applicable Regulations

The ruling standards for this equipment are:

ICAO: Annex 14, Volume I, para. 5.3.10 and 5.3.11

ICAO - Aerodrome Design Manual, Part 4 and Part 6

FAA: AC150/5345-46 and E-982 specification for what regards materials, construction performances and testing

FAA - Engineering Brief No 67: Light sources other than incandescent and xenon for airport and obstruction lighting fixtures

1.2.1.2 Equipment

1.2.1.2.1 General Requirements

The lighting fixtures shall be unidirectional, emitting green or red light.

The luminous sources shall be electro-luminescent diodes (LED's).

It shall be possible to install the lights on existing 6.6A series circuits in addition to, or in replacement of, conventional incandescent or halogen lights without having to change any other element (CCR, primary and secondary cabling, series isolating transformer, etc.). Use of transformers of a higher power rating than the light (provided the short-circuit current of the transformer does not exceed 7.2A nominal) shall not result in reduced life time nor in higher light output at full intensity.

The light shall be directly fed from the isolation transformer; separate power converters shall not be accepted.

1.2.1.2.2 Demonstration of Reliability

Keeping in mind the consequences of potential early failures, it is required from the bidder to prove the reliability of the offered lights, using as much as possible of the following proofs:

- List of references of installed lights, including at least five sites featuring an experience of at least four years and 20,000 hours of operation (in case the equipment is recent on the market, the proof can be based on other types of LED lights manufactured by the same supplier).
- Proof and description of long-term in-site testing executed on a platform and demonstrating the capability of the proposed material to withstand environmental conditions encountered on airports: weather, chemicals, heavy traffic, lightning strikes, etc. (the proof can be based on other types of LED lights manufactured by the same supplier).

1.2.1.2.3 Structural Characteristics

Each light shall include the following components or sub-assemblies:

- Central body, made from aluminium alloy, and containing the following elements:
 - slip fitter for installation on 60 mm O.D tube
 - adjustment mechanism
 - main housing, supporting a front and a rear cartridge
 - watertight cable stress reliever
- Hinged and removable front cartridge, aluminium alloy, containing the LEDs and following optical components:
 - Front glass seal
 - Front glass, thermal shock resistant
 - Front glass securing clamp
 - Front cartridge gasket
 - LED assembly and lens
- Hinged and removable rear cartridge, aluminium alloy, containing the main electronic board and a rear cartridge gasket

It shall be possible to open and replace the front and rear cartridge without use of any tool. Use of losable screws is not permitted.

Replacement of the front or the rear cartridge shall not disturb the alignment of the light.

All components shall resist the temperatures encountered during the normal operation of the fixture, at full intensity, under maximum ambient temperature

The supply cable shall run through the central body to the breakable coupling and shall have an FAA L-823 (AC 150/5345-26) style 1, fig.1 (a) plug moulded at one end. Length of the cable shall be no less than 0.5 m and it shall be flexible

The assembly shall be sturdy and as small as possible, to present a minimum resistance to the aircraft engine jet blast

The setting of the elevation angle shall be done through two opposite adjustment screws ensuring optimal stability under the vibrations

The hardware shall be plain stainless steel throughout

The design and construction shall be in accordance with the main mechanical and testing requirements of FAA E-982 specification.

The protection degree of the fitting shall be IP 54 or better.

Lighting fixtures with LED technology shall present a MTBF at full intensity (6.6A) of not less than 56,000 hours.

1.2.1.2.4 Electrical Performances

- A galvanic insulation shall provide a protection against voltage surges (lightning strikes)
- Power consumption of the light shall not be higher than **60 VA**, with a minimum power factor of 0.9 at 6.6A
- The lights shall work satisfactorily when powered through an isolation transformer complying with FAA AC 150/5345-47 from any type of Constant Current Regulator (CCR) complying with FAA AC 150/5345-10 and IEC 61822
- A measurement of the input current shall be used to determine the current provided to the LED's. The electronic circuit shall then use high frequency pulsewidth modulation (PWM) to generate through the LED's the current needed to provide a light output similar to that of a halogen light
- For thyristors-type CCR's, the current is interrupted by the thyristors during part of the cycles. As long as the load of the CCR is higher than 10% of its nominal value, this shall not cause LED lights to present 100Hz flickering for any current between 2.8 and 6.6A
- The light shall be able to sustain currents up to 8.25A RMS without failure, with a maximum crest factor of 3.2 for limited periods

If required, a possibility shall be offered to monitor a failure of the light. This option shall comply with the following requirements:

- The light shall react in case of failure of one LED, be it in open or in short circuit, as well as in case of a failure of the electronic board to supply the LEDs with current
- The light shall create an open circuit in the secondary loop
- A double check shall be executed to avoid false alarms in case of erroneous detection of a failure
- In normal conditions, the monitoring option shall not increase the power consumption of the light
- In case the monitoring option has worked and the light has gone into open circuit, this situation shall be stable. The reset of the light shall be manual to avoid accidental reset of a failed light

1.2.1.2.5 Photometric Performances

The light fixtures shall emit light into one direction. The light characteristics shall be compliant to the requirements specified in ICAO Annex 14, Vol. I, Appendix 2, fig. A2-3 for threshold lights, fig. A2-4 for threshold wing bar and fig. A2-8 for runway end lights.

The variation of the light output in function of the input current shall match that of a halogen light. No "steps" in the light output shall be visible when the current is increased progressively. For currents higher than 6.6A, the light output shall remain stable at the same value as at 6.6A. Specifically, it shall comply with FAA Engineering Brief N° 67.

When the current is turned on at any step of the CCR, the light output shall come up within less than 0.5 sec, avoiding the long starting time of halogen bulbs. The required beam colour shall be obtained without use of any colour filter. Colour coordinates for the five points of the primary beam shall comply with ICAO Annex14, Appendix 1, §2.

1.2.1.3 Mounting

The fixtures shall be installed according to the procedures detailed in the installation manual of the light supplier. The frangibility requirements of Annex 14 and para. 5.3.1.4 and of the Aerodrome Design Manual, Part 6, shall be fully applicable.

Threshold and runway end lights shall be mounted as close as possible to the ground. The light shall be mounted on a concrete block having an embedded, 2" conduit elbow or a base plate with 2" coupling secured to a galvanised steel deep base according to FAA specification L-867B.

The light shall be mounted on a breakable coupling having a 2", 11 TPI, threaded portion, to be screwed into the conduit elbow or into the base cover plate and ensuring the lowest possible height above surrounding ground. An electrical disconnection shall be provided at the level of the frangible part of the mounting system.

1.3 Elevated Supplementary Stop Bar Lights

1.3.1 LED type Elevated Supplementary Stop Bar Light

1.3.1.1 General

1.3.1.1.1 Description

The following specification describes all aspects related to the supply of elevated unidirectional supplementary stop bar lights (red), in compliance with the specifications. The configuration of the supplementary stop bar lights shall be compliant with ICAO Annex 14, Volume I, para. 5.3.20.

1.3.1.1.2 Applicable Regulations

The ruling standards for this equipment are:

ICAO: Annex 14, Volume I, para. 5.3.20

ICAO - Aerodrome Design Manual, Part 4 and Part 6

FAA: AC150/5345-46 specification for what regards materials, construction performances and testing

FAA - Engineering Brief No 67: Light sources other than incandescent and xenon for airport and obstruction lighting fixtures

1.3.1.2 Equipment

1.3.1.2.1 General Requirements

The lighting fixtures shall be unidirectional, emitting red light.

The luminous sources shall be electro-luminescent diodes (LED's).

It shall be possible to install the lights on existing 6.6A series circuits in addition to, or in replacement of, conventional incandescent or halogen lights without having to change any other element (CCR, primary and secondary cabling, series isolating transformer, etc.). Use of transformers of a higher power rating than the light (provided the short-circuit current of the transformer does not exceed 7.2A nominal) shall not result in reduced life time nor in higher light output at full intensity.

The light shall be directly fed from the isolation transformer; separate power converters shall not be accepted.

1.3.1.2.2 Demonstration of Reliability

Keeping in mind the consequences of potential early failures, it is required from the bidder to prove the reliability of the offered lights, using as much as possible of the following proofs:

- List of references of installed lights, including at least five sites featuring an experience of at least four years and 20,000 hours of operation (in case the equipment is recent on the market, the proof can be based on other types of LED lights manufactured by the same supplier).
- Proof and description of long-term in-site testing executed on a platform and demonstrating the capability of the proposed material to withstand environmental conditions encountered on airports: weather, chemicals, heavy traffic, lightning strikes, etc. (the proof can be based on other types of LED lights manufactured by the same supplier).

1.3.1.2.3 Structural Characteristics

Each light shall include the following components or sub-assemblies:

- Central body, made from aluminium alloy, and containing the following elements:
 - slip fitter for installation on 60 mm O.D tube
 - adjustment mechanism
 - main housing, supporting a front and a rear cartridge
 - watertight cable stress reliever
- Hinged and removable front cartridge, aluminium alloy, containing the LEDs and following optical components:
 - Front glass seal
 - Front glass, thermal shock resistant
 - Front glass securing clamp
 - Front cartridge gasket
 - LED assembly and lens
- Hinged and removable rear cartridge, aluminium alloy, containing the main electronic board and a rear cartridge gasket

It shall be possible to open and replace the front and rear cartridge without use of any tool. Use of losable screws is not permitted.

Replacement of the front or the rear cartridge shall not disturb the alignment of the light.

All components shall resist the temperatures encountered during the normal operation of the fixture, at full intensity, under maximum ambient temperature

The supply cable shall run through the central body to the breakable coupling and shall have an FAA L-823 (AC 150/5345-26) style 1, fig.1 (a) plug moulded at one end. Length of the cable shall be no less than 0.5 m and it shall be flexible

The assembly shall be sturdy and as small as possible, to present a minimum resistance to the aircraft engine jet blast

The setting of the elevation angle shall be done through two opposite adjustment screws ensuring optimal stability under the vibrations

The hardware shall be plain stainless steel throughout

The protection degree of the fitting shall be IP 54 or better.

Lighting fixtures with LED technology shall present a MTBF at full intensity (6.6A) of not less than 56,000 hours.

1.3.1.2.4 Electrical Performances

- A galvanic insulation shall provide a protection against voltage surges (lightning strikes)

- Power consumption of the light shall not be higher than **60 VA**, with a minimum power factor of 0.9 at 6.6A
- The lights shall work satisfactorily when powered through an isolation transformer complying with FAA AC 150/5345-47 from any type of Constant Current Regulator (CCR) complying with FAA AC 150/5345-10 and IEC 61822
- A measurement of the input current shall be used to determine the current provided to the LED's. The electronic circuit shall then use high frequency pulsewidth modulation (PWM) to generate through the LED's the current needed to provide a light output similar to that of a halogen light
- For thyristors-type CCR's, the current is interrupted by the thyristors during part of the cycles. As long as the load of the CCR is higher than 10% of its nominal value, this shall not cause LED lights to present 100Hz flickering for any current between 2.8 and 6.6A
- The light shall be able to sustain currents up to 8.25A RMS without failure, with a maximum crest factor of 3.2 for limited periods

If required, a possibility shall be offered to monitor a failure of the light. This option shall comply with the following requirements:

- The light shall react in case of failure of one LED, be it in open or in short circuit, as well as in case of a failure of the electronic board to supply the LEDs with current
- The light shall create an open circuit in the secondary loop
- A double check shall be executed to avoid false alarms in case of erroneous detection of a failure
- In normal conditions, the monitoring option shall not increase the power consumption of the light
- In case the monitoring option has worked and the light has gone into open circuit, this situation shall be stable. The reset of the light shall be manual to avoid accidental reset of a failed light

1.3.1.2.5 Photometric Performances

The light fixtures shall emit light into one direction. The light characteristics shall be compliant to the requirements specified in ICAO Annex 14, Vol. I, Appendix 2, fig. A2-12 to A2-14.

The variation of the light output in function of the input current shall match that of a halogen light. No "steps" in the light output shall be visible when the current is increased progressively. For currents higher than 6.6A, the light output shall remain stable at the same value as at 6.6A. Specifically, it shall comply with FAA Engineering Brief N° 67.

When the current is turned on at any step of the CCR, the light output shall come up within less than 0.5 sec, avoiding the long starting time of halogen bulbs. The required beam colour shall be obtained without use of any colour filter. Colour coordinates for the five points of the primary beam shall comply with ICAO Annex14, Appendix 1, §2.

1.3.1.3 Mounting

The fixtures shall be installed according to the procedures detailed in the installation manual of the light supplier. The frangibility requirements of Annex 14 and para. 5.3.1.4 and of the Aerodrome Design Manual, Part 6, shall be fully applicable.

Threshold and runway end lights shall be mounted as close as possible to the ground. The light shall be mounted on a concrete block having an embedded, 2" conduit elbow or

a base plate with 2” coupling secured to a galvanised steel deep base according to FAA specification L-867B.

The light shall be mounted on a breakable coupling having a 2”, 11 TPI, threaded portion, to be screwed into the conduit elbow or into the base cover plate and ensuring the lowest possible height above surrounding ground. An electrical disconnection shall be provided at the level of the frangible part of the mounting system.