



# AEROSPACE INFORMATION REPORT

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Superseding AIR1276A

## Aircraft Flashtube Anticollision Lighting Systems

### RATIONALE

This informational report covers established and stable technology that is now seldom used for new designs.

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### 1. PURPOSE:

This aerospace information report discusses various factors to be considered in the use of flashtubes in anticollision lighting systems for aircraft.

### 2. SCOPE:

This document covers red and white anticollision lights using flashtubes as the light source.

### 3. GENERAL:

- 3.1 Background: The 1960's saw increasing use of flashtubes (sometimes called condenser discharge lamps because of the circuitry to operate them and sometimes called strobe lamps because of their use in stroboscopes) as supplementary to the aircraft navigation and anticollision lighting system. On August 11, 1971, the Federal Aviation Administration revised Federal Air Regulations 23.1401 and 25.1401 to allow the anticollision light to be either aviation red or aviation white in color, as defined in FAR 23.1397 and 25.1397. At that time, the FAR's were revised to reduce the minimum value for "x" to 0.300 to allow for the blue-white color from the flashtubes.

The following-listed documents show a minimum value for "x" of 0.285:

International Commission on Illumination (CIE), Publication CIE No. 2.2 (TC-1.6) 1975 - "Colors of Light Signals"

International Civil Aviation Organization (ICAO), Doc 9051-AN/896, "Airworthiness Technical Manual"

SAE AS8017A, Minimum Performance Standard for Anticollision Light Systems

This materially broadened the application of flashtubes for anticollision lights.

#### 4. LAMP CHARACTERISTICS:

4.1 Electrical: The flashtube is essentially an arc chamber or tube made of glass or quartz with an electrode sealed in each end. The size of the arc chamber, which is normally filled with xenon gas, is determined by its operating parameters, voltage, required light output, etc.

4.1.1 Triggering: A third electrode, usually attached to the external wall of the arc chamber, is needed to trigger the flash. This electrode is usually a conductive coating applied to the tube or a fine wire wrapped around the wall of the lamp.

Also, a metal reflector which is electrically isolated from ground can be used as a third electrode in conjunction with the conductive coating on the lamp.

4.1.2 Flashtubes are used in a capacitor discharge circuit (Refer to Fig. 1). The basic components of the circuit and their functions are:

- a. DC Power Supply: This is a relatively high voltage (normally 300 – 500 V) and is usually obtained from an alternating current rectifier or from a transistorized DC to DC converter.
- b. Current Limiter: This limits the charge rate of the energy storage capacitor, allowing the flashtube to deionize and extinguish after a flash.
- c. Control Circuitry: Control circuitry is configured to shut down the power conversion stage at the conclusion of each flash. The duration of shut down is only long enough to allow the flashtube to deionize and extinguish. This eliminates the possibility of the flashtube going into an afterglow condition which could result in a continuous load on the power supply.
- d. Capacitor: This stores the energy for the flashtube.
- e. High Voltage Trigger Circuit: This is usually a simple step-up-transformer pulsed by an SCR. The high voltage pulse applied between the trigger electrode and one of the end terminal electrodes of the flashtube ionizes the gas, which allows the capacitor to discharge through the flashtube.
- f. Light Generation: The electrical energy discharge inside the flashtube ionizes the xenon gas. The ionized xenon gas produces light with a characteristic blue-white color.

4.2 Illumination: Flashtubes have a characteristic light-time curve with a very high peak intensity and a flash duration on the order of a millisecond. In general, higher voltage operation will provide a shorter flash duration and vice versa for the same energy per flash. Circuitry can also affect the flash duration.