Transport of Aircraft Engines with Radioactive Spark Gaps

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24 June 2019
Aircraft Engines with Spark Gaps Containing Kr-85

- Aircraft gas turbine engines utilize spark gaps containing Kr-85 in the ignition exciter. Each ignition exciter may contain between 1 and 3 spark gaps.

- When transported alone or with the ignition exciters classification is UN 2911, Radioactive material, excepted package – Instruments

- However, many aircraft engines are transported by road and by air with the ignition exciters installed in the engine and questions have been asked by regulators as to the classification of the engine.

  - in air transport, unless all fuel has been purged, UN 3528, Engine, internal combustion, flammable liquid powered;
  - in road transport – not regulated, even when containing fuel.

- What of the presence of the spark gaps?
Spark Gaps Installed in Aircraft Engines

General — Spark gaps (also called “electron tubes”) manufactured by Unison Industries are hermetically sealed, gas-filled switches with breakdown voltages ranging from 0.9 to 5.0 kVDC. The spark gap consists of a glass tube, metal end plates containing sparking electrodes, a filler gas, and the radioactive source Krypton 85 ($^{85}$Kr), which is mixed with the filler gas. By incorporating a very small quantity of $^{85}$Kr within these spark gaps, consistent ionization and de-ionization levels can be obtained, resulting in stable operation of the ignition units. It is not possible to achieve consistent ionization/de-ionization levels or the desired life expectancy with air gaps. Each spark gap is marked on the glass tube with “UNISON”, “59501” (the company’s Commercial and Government Entity (CAGE) Code), the part number plus revision letter, “KR-85” and the manufacturing date code.

Most ignition exciters contain one, two, or three spark gaps (not all ignition exciters contain spark gaps). Different spark gap part numbers contain unique amounts of radioactivity. The gaps are manufactured using gas compositions controlled by engineering specifications where the required specific activity of $^{85}$Kr is specified as millicuries per liter of gas mixture. This, along with the spark gap volume and gas mixture pressure determines the radioactivity of the spark gap. The radioactive concentration of $^{85}$Kr in the spark gap filler gas is greater than 100 kilo-becquerel per gram (kBq/g) for all spark gaps manufactured by Unison Industries. All spark gaps currently manufactured by Unison Industries have $^{85}$Kr radioactivity ranging from 1.4 kBq (0.04 microcurie) to 161.6 kBq (4.37 microcurie).
Two ignition exciters mounted on an aircraft engine
Close-up of the two ignition exciters
Aircraft engine on a cradle ready to be shipped
Thank you

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