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NASA TECH BRIEF

Ames Research Center

Multilayer Flat Electrical Cable

A flat electrical cable developed to meet stringent requirements for use in nuclear power supplies may also be of general use for construction of other instruments. Besides being lightweight and flexible over a temperature range of −129°C to +177°C, and withstanding continuous exposure to high levels of nuclear radiation, the flat cable also can carry high currents with a minimum of temperature rise; its magnetic cleanliness is equal to or better than a twisted pair of wires, and it can be terminated in a conventional electrical connector.

Light weight and flexibility are obtained by use of an aluminum foil conductor in a flat configuration. The flat configuration provides a large area of heat-radiating conductor surface and, since the conductors are coated with black epoxy paint, heat generated in the center foil is rapidly transmitted to the radiating black epoxy surface of the outer foils. Three layers of conductor foils are used to provide magnetic cleanliness; when the positive potential is connected to the center conductor and the negative side to the outer foils, the resulting magnetic field is much less than a twisted-pair conductor.

Each conductor foil is insulated from the other with very thin sheets of a polyimide resin coated with a fluorocarbon resin. The polyimide film has good resistance to high levels of nuclear radiation and flexibility over the specified temperature range. The edges of the insulating material, which extends beyond the conductor foil, are bonded to form the three-conductor cable.

A transition from flat foil to round wires (so that the cable can be used with conventional connectors) is made at the end of each conductor foil by resistance-welding standard, silver-plated, polyimide-insulated wires to the aluminum foils; metallurgical bonding of the wire strands to the foil is the result of formation of a lower-melting, silver-aluminum eutectic in the weld zone. The ends of the flat cable are encapsulated with a high-temperature epoxy resin to impart mechanical strength to the weld area.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Ames Research Center
Moffett Field, California 94035
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Patent status:

NASA has decided not to apply for a patent.

Source: Philip G. Silverman of
TRW Systems Group
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Category 01