Technology Focus: Fastening/Joining/Assembly Technologies

Stable, Thermally Conductive Fillers for Bolted Joints

Lyndon B. Johnson Space Center, Houston, Texas

A commercial structural epoxy [Super Koropon (or equivalent)] has been found to be a suitable filler material for bolted joints that are required to have large thermal conductances. The contact area of such a joint can be less than 1 percent of the apparent joint area, the exact value depending on the roughnesses of the mating surfaces. By occupying the valleys between contact peaks, the filler widens the effective cross section for thermal conduction. In comparison with prior thermal joint-filler materials, the present epoxy offers advantages of stability, ease of application, and — as a byproduct of its stability — lasting protection against corrosion. Moreover, unlike silicone greases that have been used previously, this epoxy does not migrate to contaminate adjacent surfaces. Because this epoxy in its uncured state wets metal joint surfaces and has low viscosity, it readily flows to fill the gaps between the mating surfaces: these characteristics affect the overall thermal conductance of the joint more than does the bulk thermal conductivity of the epoxy, which is not exceptional. The thermal conductances of metal-to-metal joints containing this epoxy were found to range between 5 and 8 times those of unfilled joints.

This work was done by Raymond J. LeVesque II; Cherie A. Jones; and Henry W. Babel of McDonnell Douglas Corp. for **Johnson Space Center.** *Further information is contained in a TSP (see page 1).*

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act [42 USC 2457 (f)], to

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Refer to MSC-23066, volume and number of this NASA Tech Briefs *issue, and the page number.*

Connecting to Thermocouples With Fewer Lead Wires

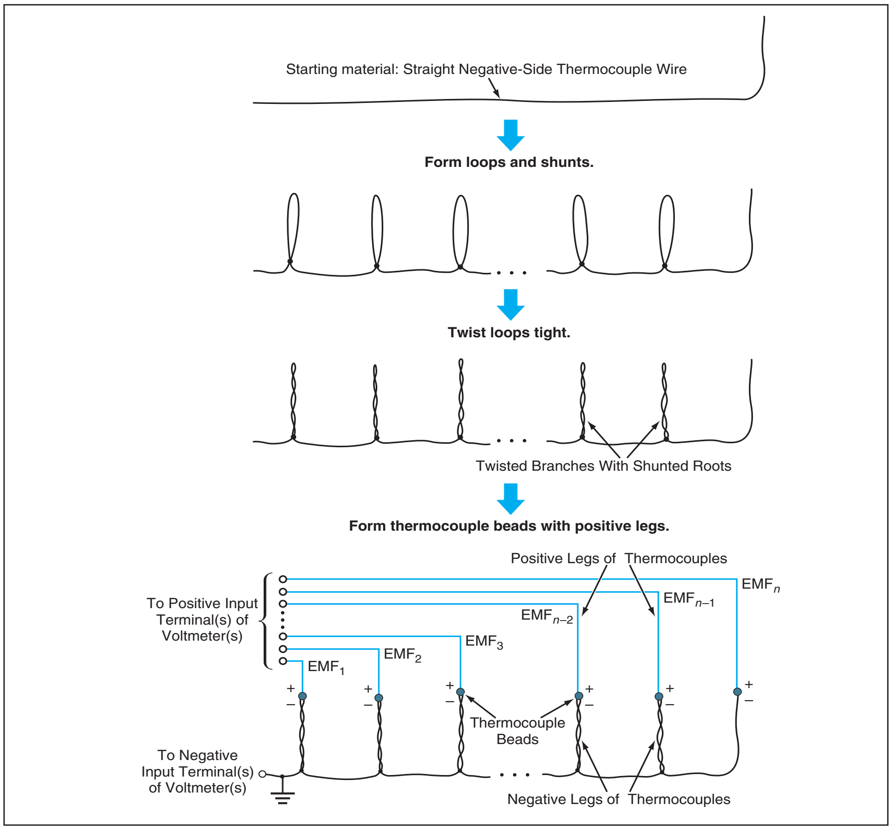
For N thermocouples, only $N + 1$ wires are needed.

John H. Glenn Research Center, Cleveland, Ohio

A simple technique has been devised to reduce the number of lead wires needed to connect an array of thermocouples to the instruments (e.g., voltmeters) used to read their output voltages. Because thermocouple wires are usually made of expensive metal alloys, reducing the number of lead wires can effect a considerable reduction in the cost of such an array. Reducing the number of wires also reduces the number of terminals and the amount of space needed to accommodate the wires.

Heretofore, it has been standard practice to use a separate lead wire to connect to each side of each thermocouple. In other words, it has been standard practice to use $2N$ lead wires to connect to N thermocouples.

The essence of the present technique is to use one common, grounded wire for the negative sides of all the thermocouples in the array and to connect the positive side of each thermocouple, in the customary manner, to the positive terminal of the instrument used to read its output. Fabrication of the array begins with twisting of the single negative-side wire to form branches for thermocouples (see figure). The



A **Single Common Wire** for the negative sides of N thermocouples is formed into a branched wire. The thermocouples are formed at the tips of the branches.