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LX-10 PRESSING STUDIES

J. Douglas Harrell

DEVELOPMENT DIVISION

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Process Development
Endeavor No. 105

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ABSTRACT

The process for press-loading LX-10 into the Unicores ring has been abandoned. The present process uses premachined explosive parts glued into the ring recess. Final machining produces the finish dimensions. Using a premachined part allows the density to be measured quite accurately, which was always in question with the press-loading process, and decreases the likelihood of flux density losses suspected to be caused by the press-loading process.

DISCUSSION

The earliest Unicores assemblies, made for concept evaluation, were assembled with completely machined and dimensioned rings of explosive. The rings were delicate and difficult to generate, with a high reject rate. Compacting the explosive in place, then machining only the exposed surfaces to design specification was adopted to provide the maximum amount of material in the preformed ring.

The process of press-loading used a normal compaction pressure of 140 MPa. The ring and raw explosive powder were confined in a custom fitted wet-bag assembly during the

compaction. The compacting pressure, applied simultaneously to all outer surfaces, caused only minor changes to the gross dimensions of the ring. While the gross mechanical distortions were small, decreasing the outside diameter up to 0.08 mm, the magnetic properties were being altered significantly.

The altered magnetic properties, as measured by the magnetic flux density, ultimately required process changes that do not expose the ring to severe forces. Several earlier experiments were made with the objective of reducing the ring distortion during press-loading operations. Pressures as low as 84 MPa, with containment in soft rubber

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for even pressure transmission, distorted the rings enough to cause a decrease in flux density of 21.7 lines/mm (550 lines/inch).

Fig. 1 shows the decrease in magnetic flux density at various stages of processing. The points connected by the dotted line are averages from 8 rings, remeasured after each stage of process. Other points on the graph were experiments of loading materials or pressure. Variations in the data are indicated by the vertical bars of one sigma value.

The present process uses a prepressed LX-10 billet (140 MPa for 5 minutes, ambient temperature) that is partially machined and glued into the ring recess. The LX-10 is finish-machined after the gluing is completed. Having the LX-10 separate at a process point allows accurate measurement of density (an unknown feature when the explosive was press-loaded in place). The density of the first 20 parts machined ranged from 1.830 to 1.832 Mg/m³.

Fig. 1. Change of Magnetic Properties Due to Processing

A flow chart of the present process is shown in Fig. 2.

CONCLUSIONS AND COMMENTS

Adoption of the premachining process is well underway; there will yet be minor changes made, but 12 rings have been fully processed by the new procedure and the final quality is acceptable.

There are two problems intrinsic to the new process; i.e., (1) the LX-10 contour must have a reasonable clearance to the ring recess surface (not intimately formed to the recess wall as when press-loaded) and this reduces the charge weight by approximately 8%, and (2) the thickness of the adhesive joint between the HE and the recess wall will be a questionable feature, not easy to resolve as a definite dimension.

Fig. 2. Flow Chart Unicore Rings