

Prototyping and Knowledge Sharing for Rapid Braze Fixture Technology: An Effective Combination to Decrease Lead-Times and Increase Yields

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Abstract

The benefits of a thorough prototyping effort and the subsequent transfer of the applicable process knowledge to manufacturing agencies can greatly reduce manufacturing development costs while improving yield. It has become increasingly easy to generate a drawing or solid model of an assembly, email it to manufacturing facilities and wait for the return of the fabricated hardware. However, the end-use product designers may have little or no knowledge of the fabrication processes required, which can lead to an iterative fabrication process resulting in substandard assemblies which are delivered, rejected, revised, and delivered multiple times until the desired level of performance is obtained. If neither the designer nor manufacturer has the required process knowledge, the result can be a relaxing of product requirements which leads to substandard product. Another result can be low process yields that can impact profitability and the meeting of production schedules. Successful prototyping efforts can be produced when organizations with the applicable processing experience work closely with the design agencies to make design changes for manufacturability prior to handing off the work to a manufacturer. For activities that require brazing, this could involve redesigning braze joints or joint clearances; designing, building and proving fixtures; as well as sharing process knowledge with the manufacturing agency to increase production yields. A rapid, agile and cost effective method to make ceramic fixturing will be discussed along with the benefits of sharing the fabrication knowledge acquired during the prototyping effort. Lessons learned from a real example of a successful partnership between designer, prototyping facility and contract manufacturer will be discussed.

Goals

- Build and deliver 50 prototype units using an optimized fabrication process
- Identify and utilize rapid manufacturing methods to reduce lead-time and cost
- Transfer the process to contract suppliers

Methodology

- Review and modify assembly drawings for proper joint design and fit
- Procure piece-parts with optimized dimensions
- Design and laser machine multilayer alumina ceramic fixture
- Develop robust joining process
- Test and inspect to insure parts meet or exceed drawing specifications
- Share process knowledge with manufacturing agencies

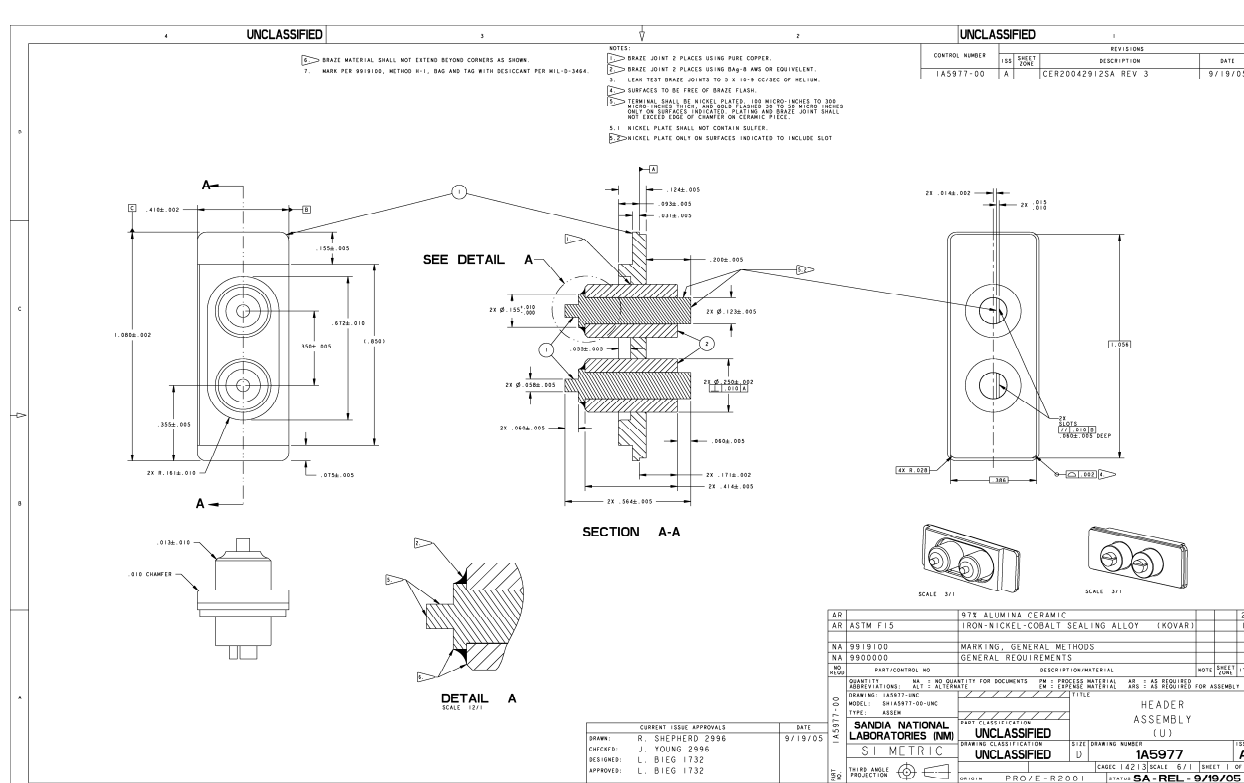
Limitations

- Raw materials fixed
- Header plate previously procured
- Joint designs fixed, only joint clearances can be modified

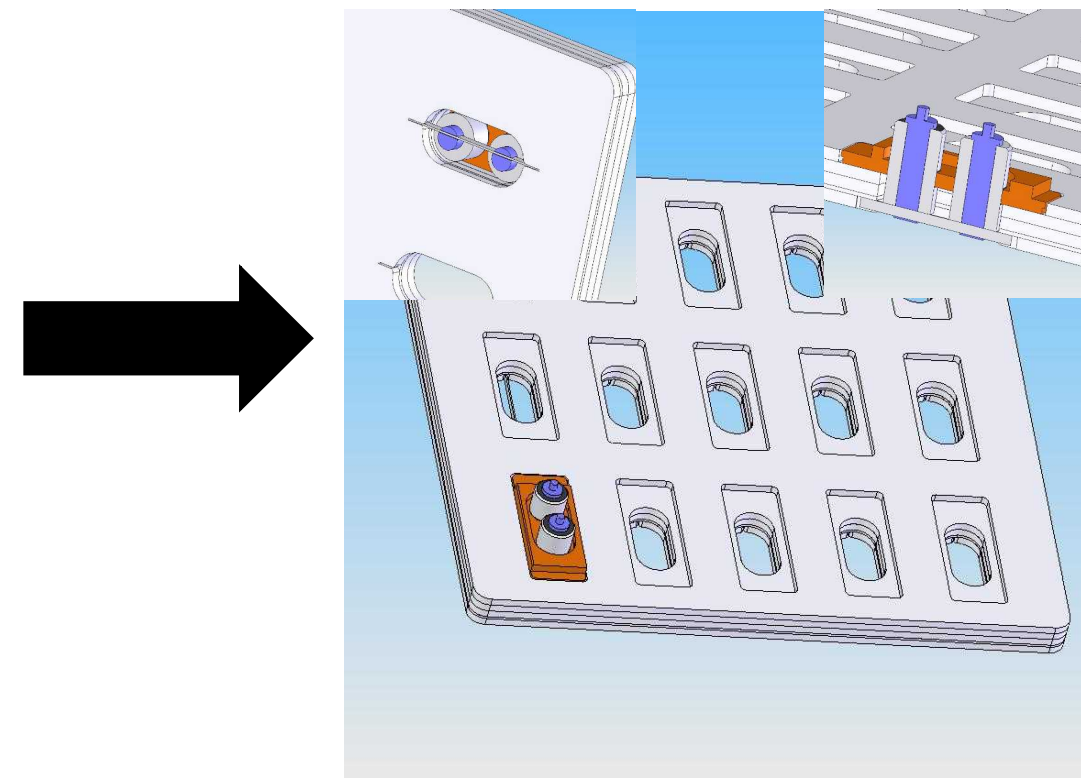
Conclusions

- Laser machined multilayer alumina fixtures can be obtained for 10% of the cost of monolithic ceramic fixtures and at greatly reduced lead times
- Well-planned prototyping efforts by experienced personnel can add high value while reducing production start-up time
- Proper attention to joining requirements leads to increased product yields

Review drawings



Design Brazing Fixture



Procure Parts

Kovar Bodies
Kovar Pins
Metallized alumina ceramic bodies
Braze filler metal preforms

Laser Machine Fixture



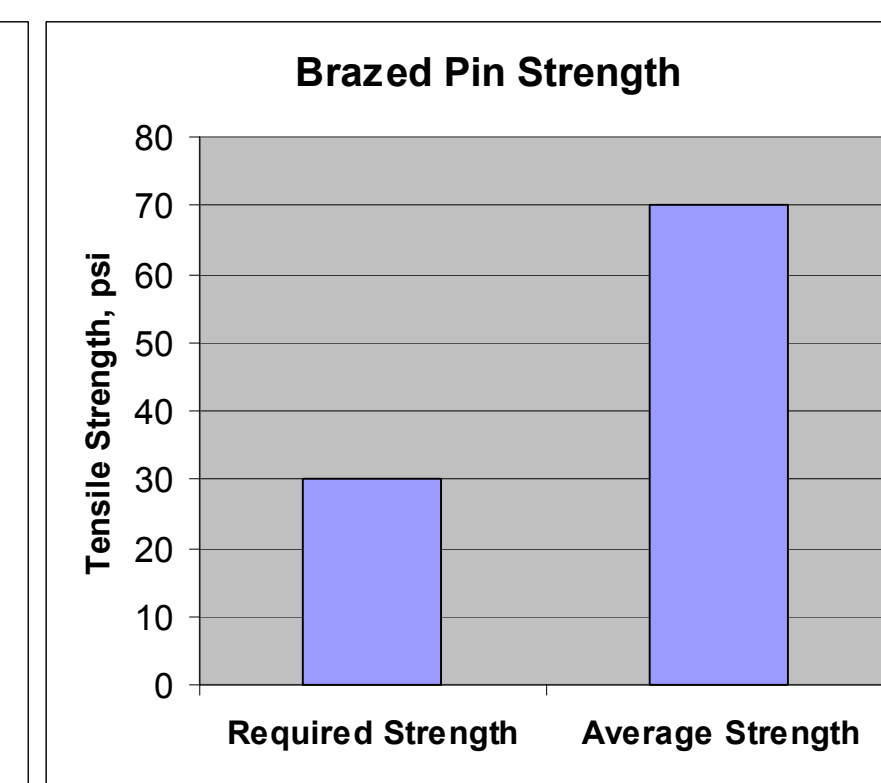
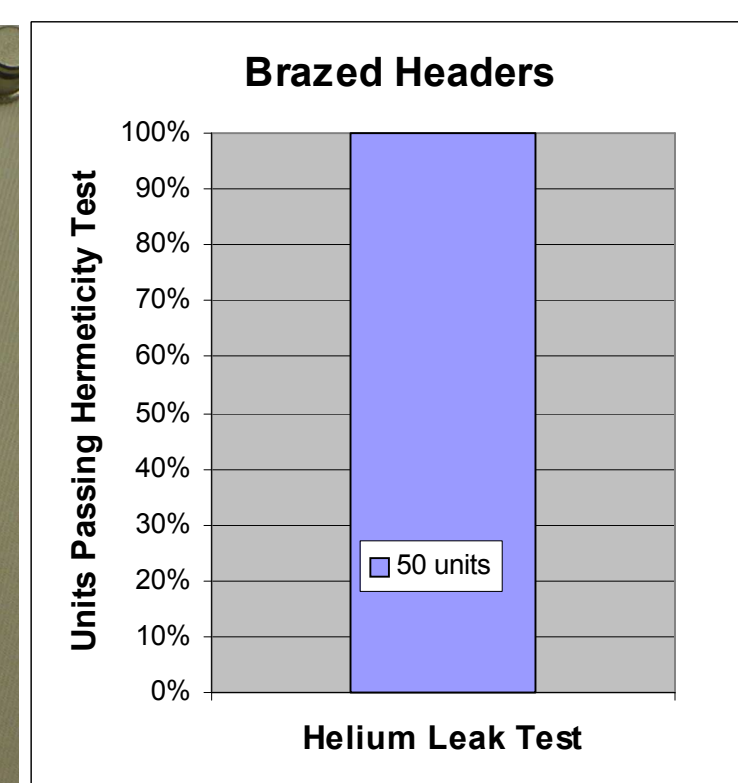
Form Test Plan

Number of qualification runs
Braze filler metal selection and braze preform sizes
Atmosphere selection
Braze fixture temperature uniformity tests
Temperature profile development
Hermiticity and Pin/Sleeve Tensile tests
Braze and test final product

Validate Fixtures

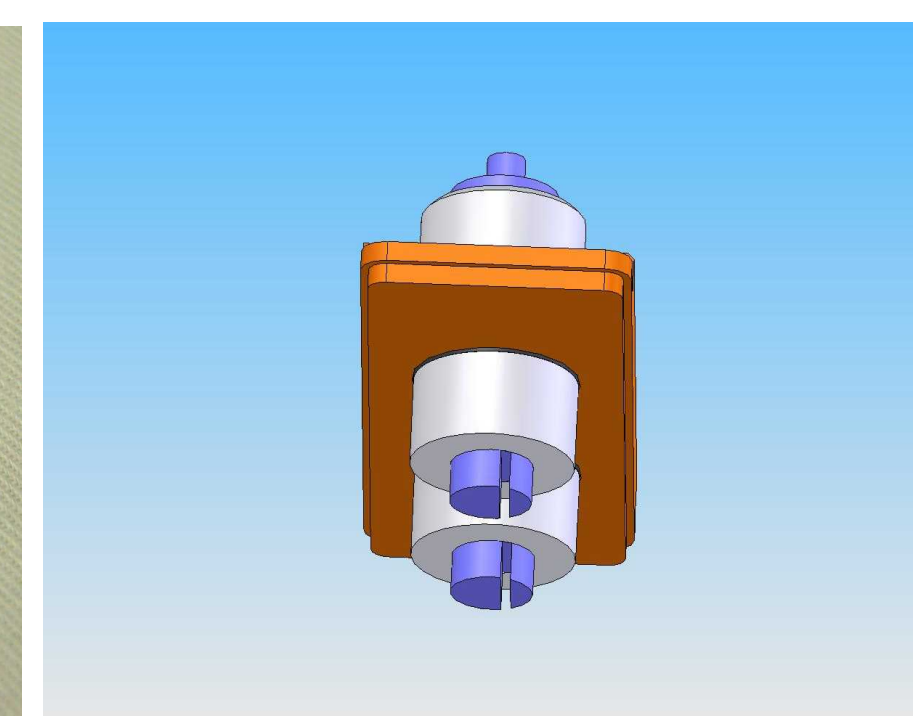
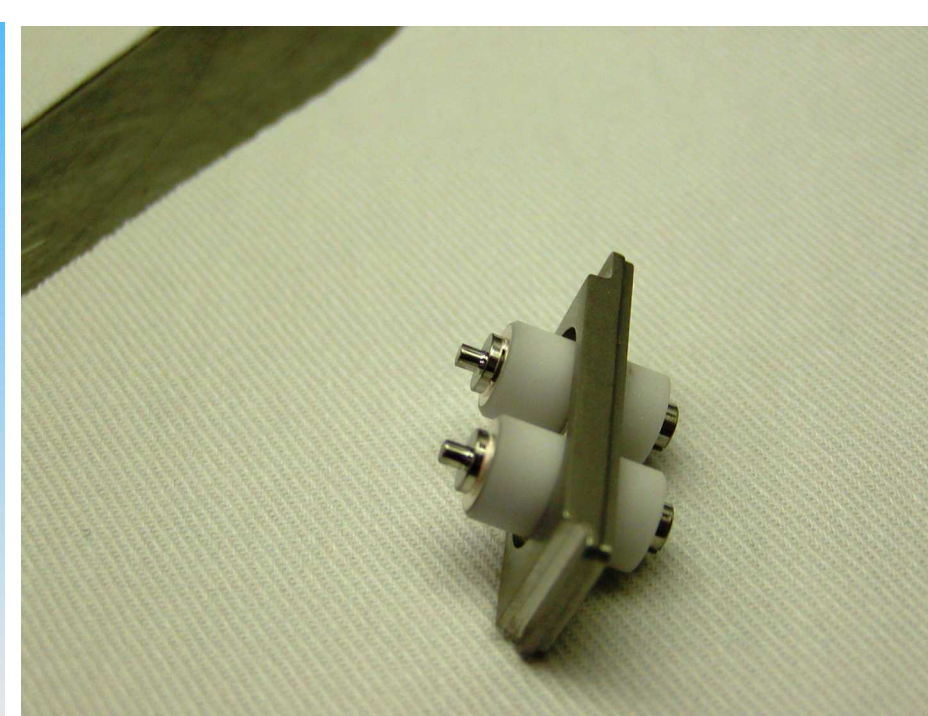
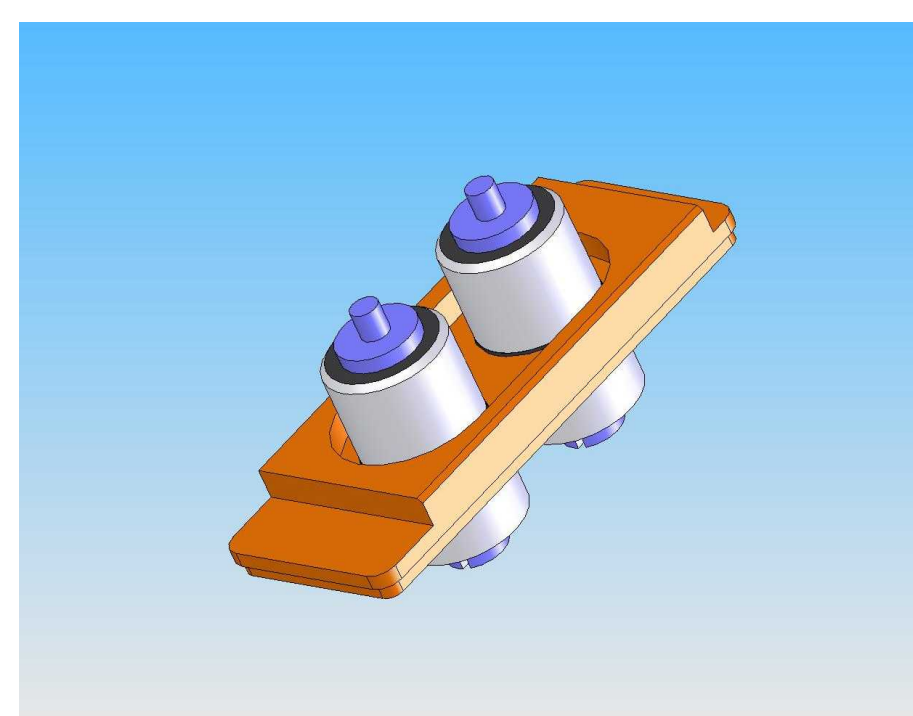


Braze & Test Assemblies



Document Process

Share Process Knowledge



Fixture Fabrication Method

Delivery Time
12-16 weeks

Cost
\$10k-\$12k

2 weeks

<\$1k

Monolithic Fixture

Laser-Machined Fixture