ALMAY RESEARCH AND TESTING CORPORATION
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The purpose of this test was to compare the effect on fatigue life of 7075-T651 aluminum under the following conditions:

1. Plain tapped thread
2. Heli-Coil® inserts installed in cut thread tapped holes
3. Heli-Coil® inserts installed in rolled (cold formed) tapped holes
4. Thin wall solid bushing with swaged collar
5. Solid bushing with keys

The test procedure involved the use of test coupons that were designed to provide a wall thickness of approximately twice the insert diameter. The specimens were all ½" thick to allow the installation of ¼-28 screw locking inserts to 1 ½ diameter length. The tension-tension cyclic fatigue test was then conducted on the Amsler Vibrophore Fatigue Tester. The maximum loads were established at 50% and 30% of the ultimate tensile strength of the aluminum. The minimum load was established at 5% of the maximum load. These relatively high load values were chosen so that the large number of specimens in the study could be tested in a reasonable amount of time.

To simulate a typical assembly, NAS 1351 Series cadmium plated alloy steel cap screws and washers were assembled into the inserts and tightened to 70 inch-pounds. The clamping load on the screw develops stresses in the parent material that are typical of actual assemblies.

- Test results comparing the effects of the presence of the various inserts are shown in the graphs (below).
- Heli-Coil® insert assemblies were also compared to the plain tapped hole that in ductile aluminum represents the theoretically perfect model where the load is distributed equally to all threads, thus minimizing stress concentration. At a stress level of 30% - a very high value for practical applications - the fatigue life for both types of assemblies was virtually identical. These comparisons prove that in typical applications where the stress levels are in the normal ranges, the Heli-Coil® insert distributes the load as effectively as the ductile aluminum parent material.
- Heli-Coil® insert assemblies in normal cut thread tapped holes were compared to cold formed tapped holes. The results were interesting in that the fatigue life for cold formed threads was reduced by 65% at the 50% stress level and by 45% at the 30% stress level. The obvious conclusion is that the cold forming preparation of tapped threads creates high residual stresses in the parent material that significantly reduce the fatigue life of that material.