Instrument Specialties Co., Inc.
Finite Element Analysis Report
Model #: Sk001047 Rev. X4

Requested By: Benjie Sun/SGI Distribution: Benjie Sun, Rich Boucher

Objective:

The objective of this test was to determine a finger profile that could be fabricated from stainless steel and withstand the prescribed deflection without overstressing and relaxing.

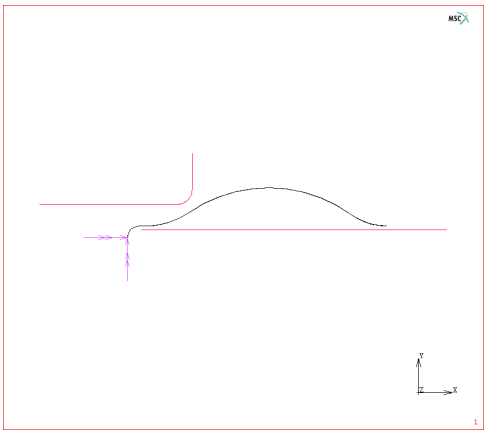
Part Description:

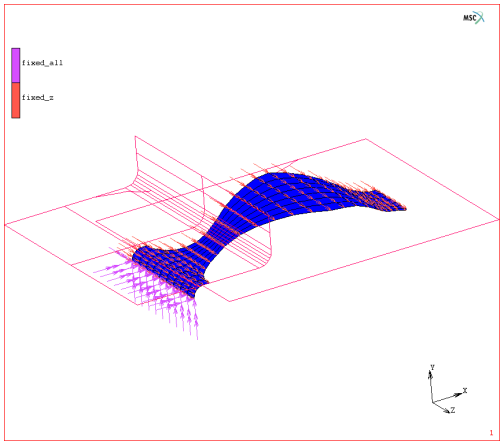
Material: 301 Stainless Steel (minimum allowable yield strength of Half Hard is 110ksi)
Thickness: 0.004 inches [0.102mm] and 0.005 inches [0.127]
Model #: Sk001047
Boundary Conditions: constrained along the radius due to geometry of the entire part; fixed deflection in the z-direction.
Contact Conditions: a frictionless surface will contact the finger in the x-direction and deflect the part to a gap of 0.050 inches; a fixed surface will restrain the finger in the y-direction and force open the large radius. These contact conditions occur on both the side contacts and the top contacts.

Test Performed:

Finite Element Analysis - The analysis performed is a non-linear shell analysis using quad4 elements. Contact analysis was used to simulate contact between a fixed surface and the part, and the moving body and the part. The attached surface restrained the part in the –y direction only. The moving body deflected the part in the –y direction to a gap of 0.050 inches [1.27mm] after making contact.

Setup:





Test Results:

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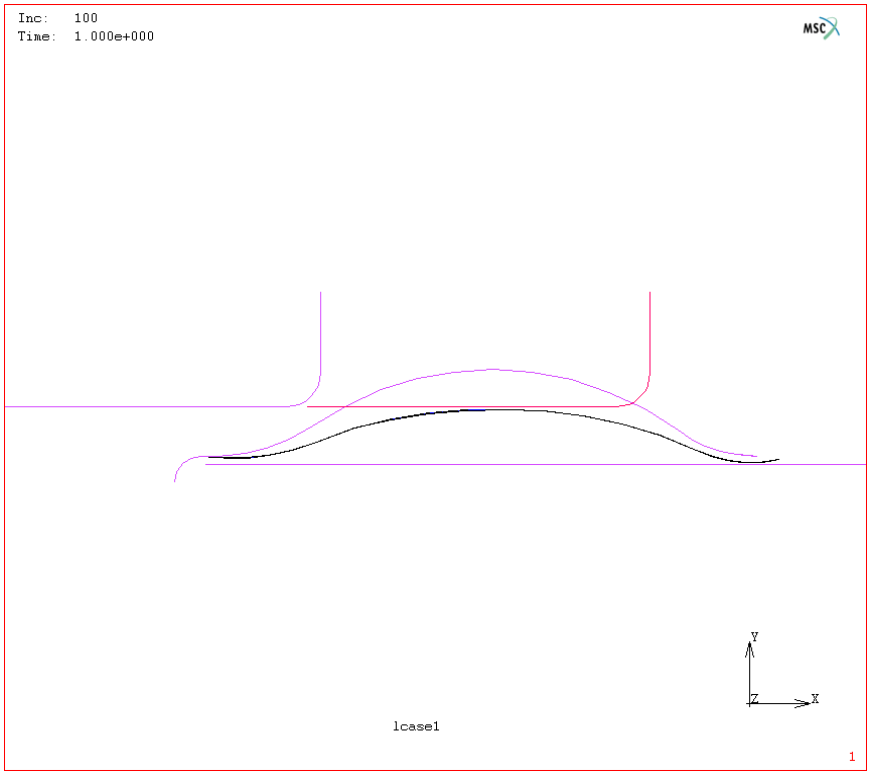
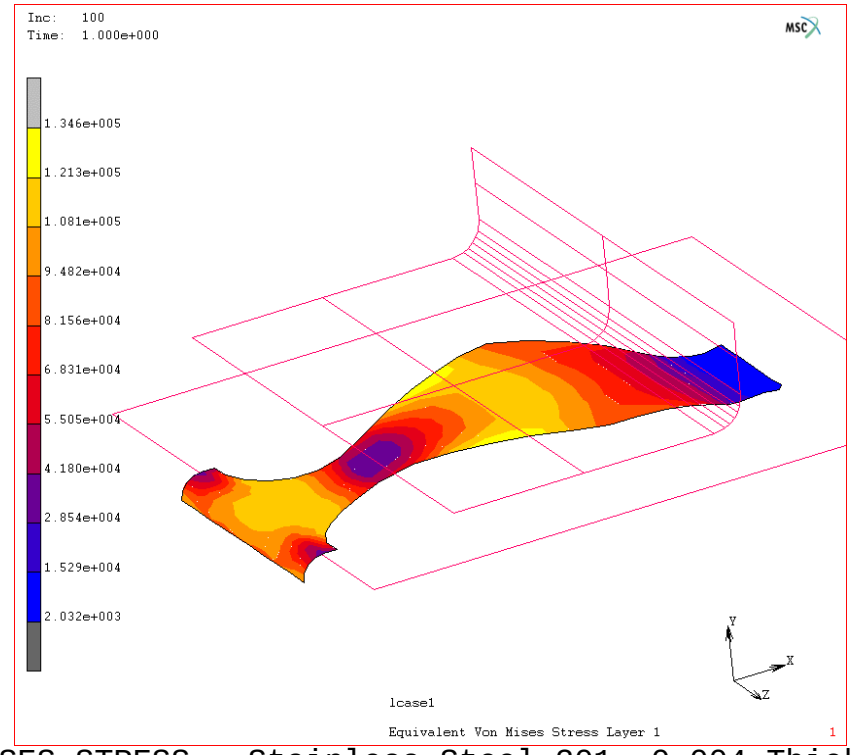
Deflected to a 0.050” [1.27mm] gap



Von Mises Stress – Stainless Steel 301, 0.005 Thick



VON MISES STRESS – Stainless Steel 301, 0.004 Thick (psi)

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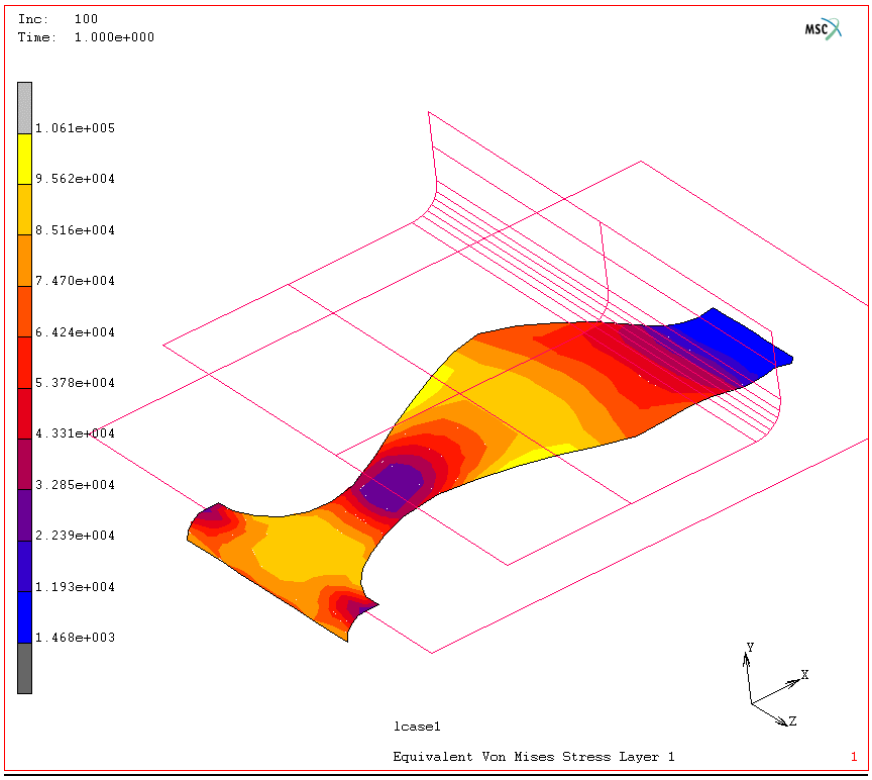

CONCLUSIONS

The contact at 0.004 inches thick gives some margin of safety and should be implemented for this project. Based on previously fabricated samples, the reduction from 0.006 inches (the thickness of the original samples) to 0.004 inches in thickness will not hinder the handling and installation of the complete part. The unique geometry of the contact provides a tapered beam effect and maximizes the distribution of the stresses.

Further analysis of the results provides normal force data in the y-direction of 0.67 pounds per finger and insertion force data in the x-direction of 0.26 pounds per finger. The normal force is higher than needed for good contact, but can only be reduced by thinning the material; this will affect handling and installation and is probably not necessary. The insertion force is at an acceptable level and will result in a total insertion load of approximately 4.4 pounds per wrapper.

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