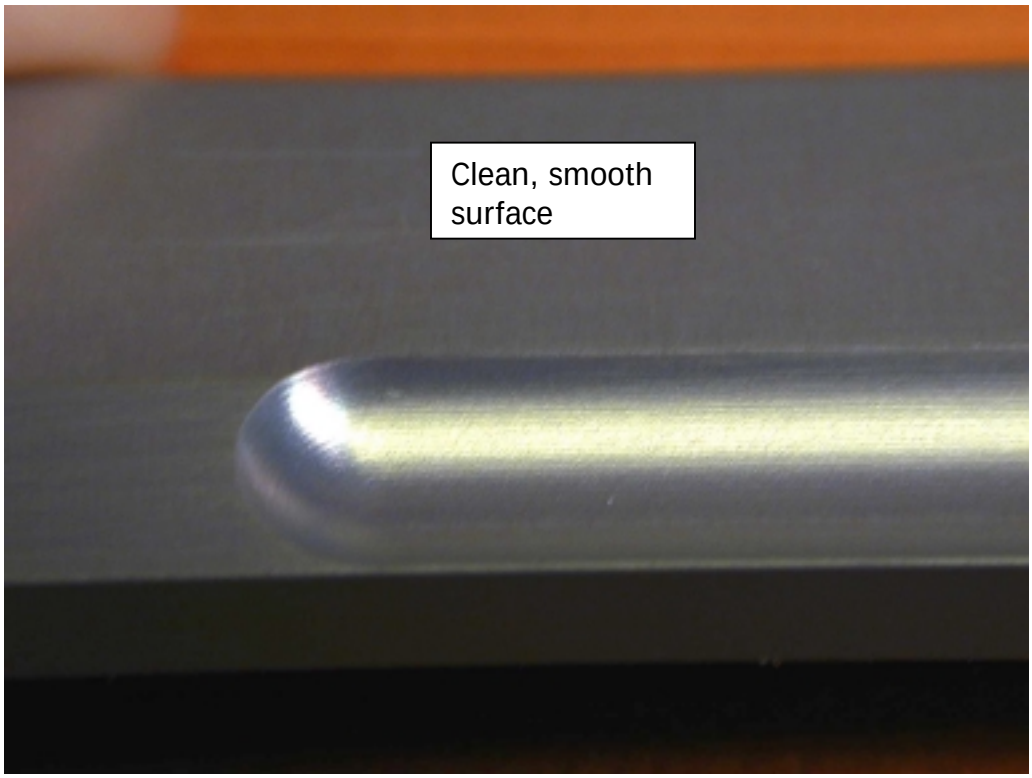
Leading Edge Clamp Machining Problem

We recently (summer, 2000) received a batch of leading edge clamps that were machined to the edge of our tolerance. When tested, the parts failed. The failure will not always be catastrophic, which makes detection more difficult.

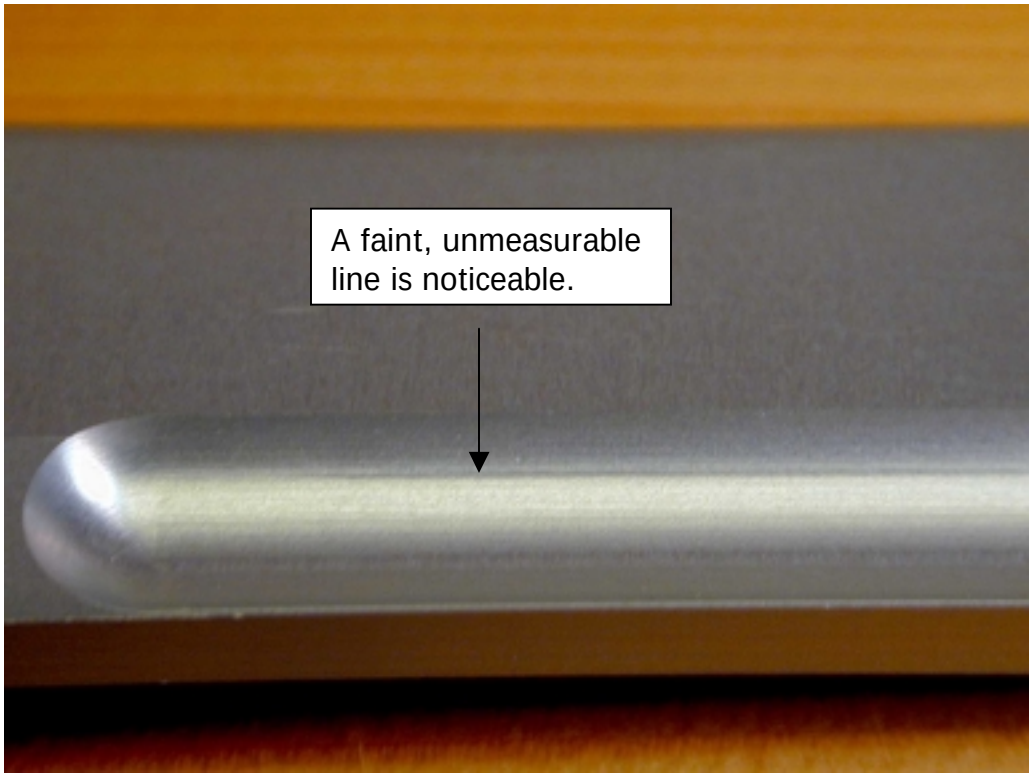
The failure was measured by the leading edge gap. This gap value changed throughout the test, getting progressively smaller. This will lead to loading, plate pucker, and plot problems.

The problem is the amount of material between the groove on the front and a groove on the back. The front groove, for the pushbar, should be 0.5mm from the rear groove, designed for adding weights. When the tolerances are stacked, this 0.5mm is reduced to virtually nothing.

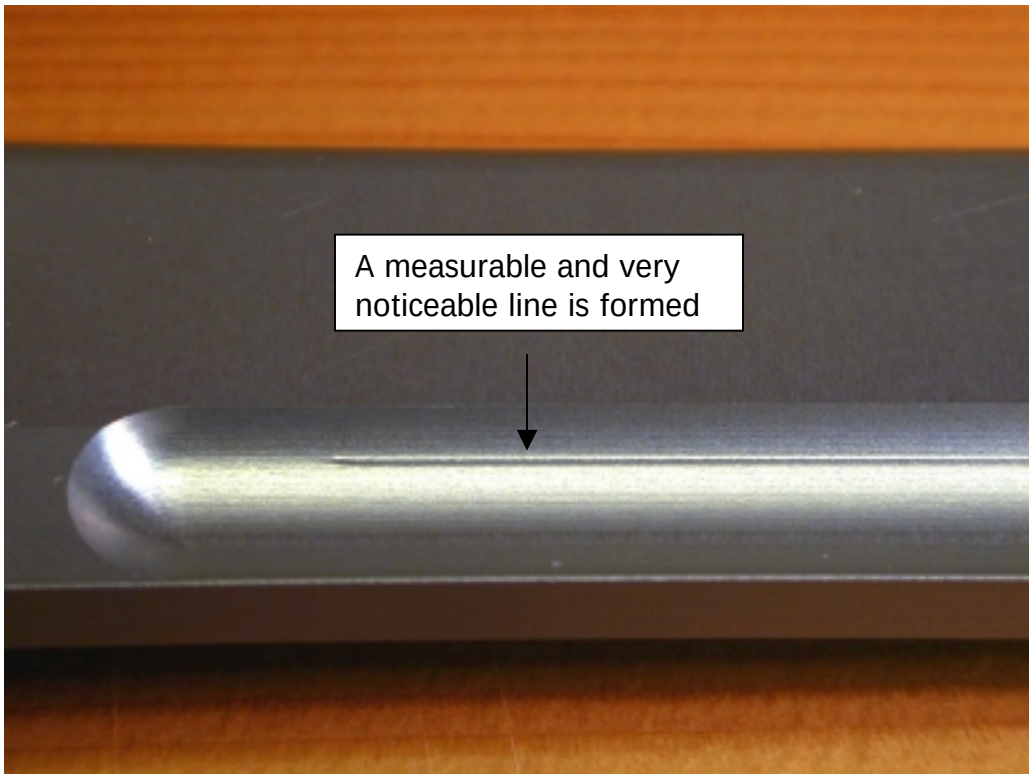
The following pictures show the varying severity of such a machining problem. The first picture shows a good clamp. This clamp passed 1,000,000 cycles.



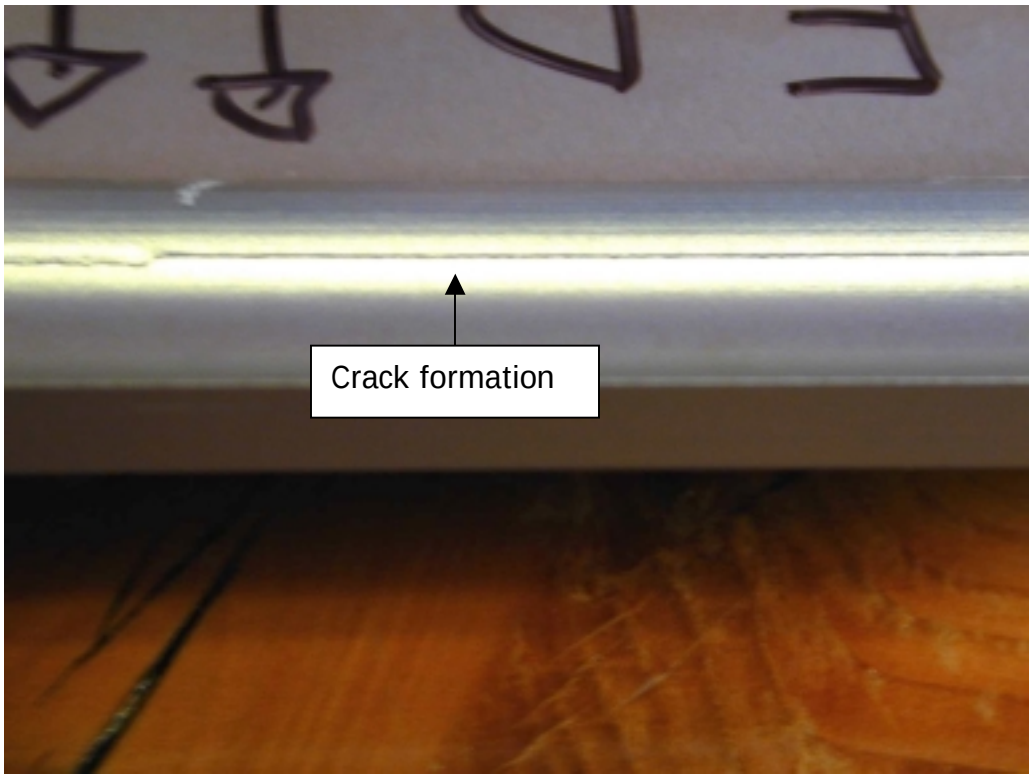
The next picture shows a faint line where the 2 cuts would meet. This clamp will fail after about 200,000 cycles. The failure mode is fatigue that causes a permanent gap reduction.



This picture shows a measurable bump where the cutting tool has pushed the thin, remaining material out. This clamp will fail within 20,000 cycles. Again, it will not necessarily fail by breaking. It will deform such that the gap is permanently reduced.



The last picture shows a clamp that did fail catastrophically. A crack formed along the line where the 2 cuts meet. Large gap reduction will result. The problem will continue to manifest itself as a loading, plate pucker, or plotting problem.



The problem is being rectified. We are redesigning the clamps. Again, not all machines are affected. Most clamps are fine and pass 1,000,000 cycles without noticeable gap changes. However, there are a few that may have been installed on machines in the field. Only the faulty clamps need to be replaced.