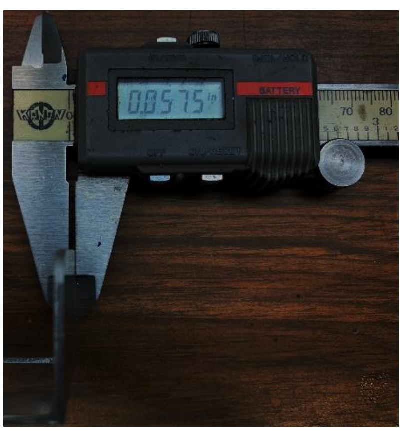
A Quick Acting Strap Buckle, Version 2.1

By R. G. Sparber

One inch wide strap is both lightweight and strong. Even this low-cost strap has a working tensile strength of 600 pounds. I have run into one problem – making an end loop around a closed object. Here you see the strap fished through the handle of my mill. How do I secure the working end? If this was a rope, there would be a multitude of knots that are quick to tie, strong, and quick to release. But have you ever knotted strap? Sure, it is quick to tie and strong. But untying can take a long time.

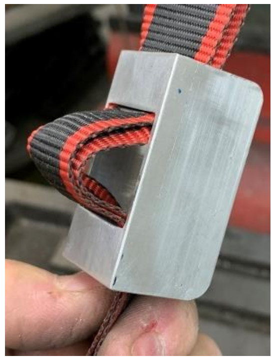
The buckle offered here is quick to attach, strong, and quick to release.

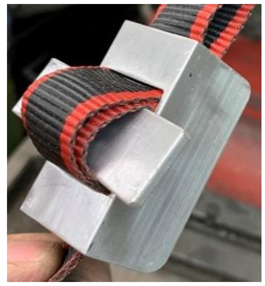


Why in the world would I make the buckle out of soft aluminum channel only 0.0575-inches thick? I wanted to “fail fast” and “test to failure.” Both of these terms should warm the heart of any engineer worth their salt.

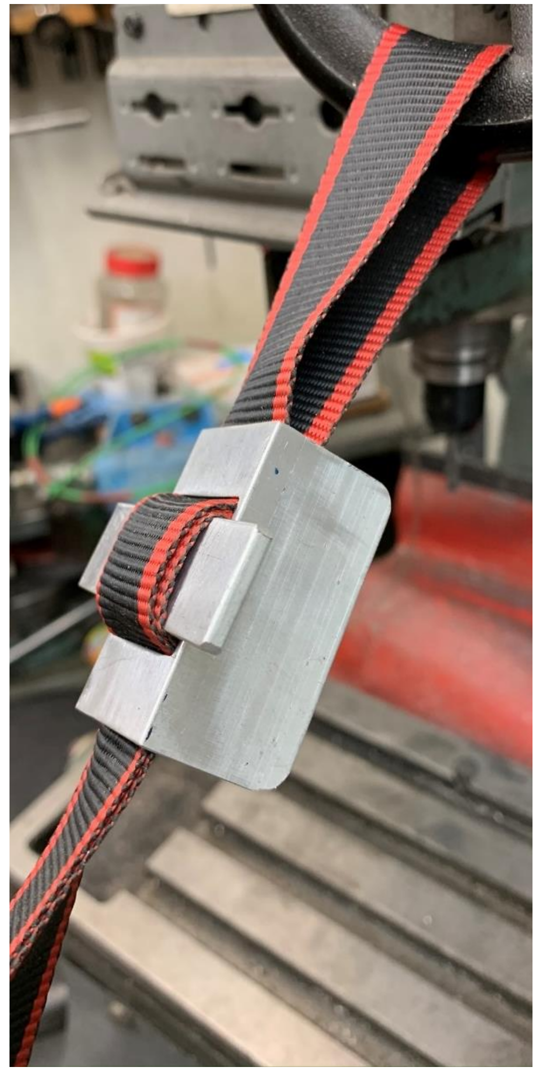
This aluminum is easy to drill and file. It is also so soft that I can bend the sides of the channel with my fingers. I wanted to apply enough tension to make the buckle fail so I could learn its weak points. The next prototype could be made from thicker aluminum or even steel.

Using the Buckle





Loop the working end through the anchor hole, drop on the buckle, push the strap up through the square hole, slide in the bar, and pull tight.



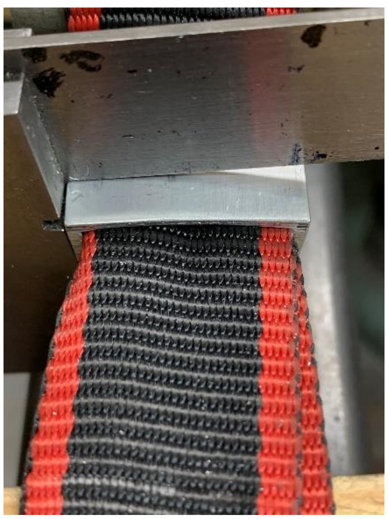
The buckle is ready for service.

When done, release the tension and pull out the bar. The buckle falls off.

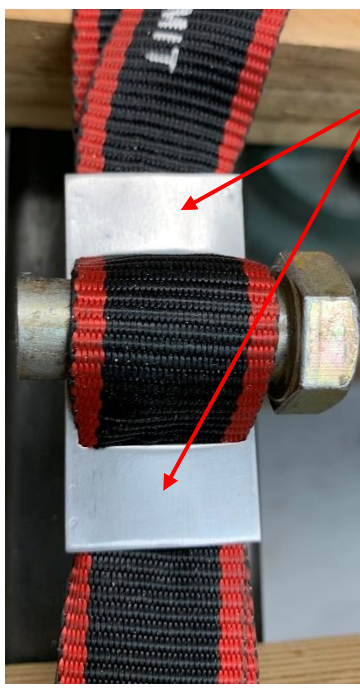
Time to test the buckle to failure. I used a piece of steel tubing and a ratchet strap. The wood blocks enabled me to inspect the buckle in tension.

I don’t own a scale able to read this tension but can operate the ratchet either until I or the buckle fail. Note that I used a piece of ½-inch diameter steel as my bar. I was testing the buckle and didn’t want the bar to fail first.

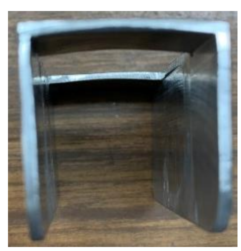
With safety glasses on and standing to the side, I tightened the strap as much as I could. The buckle held.



I could see that the top of the buckle crowned, and the flanks bent inward. My square, referencing one flank, tells the story.



The bar is pushing on the edge of each flank while the flat part of the buckle is being lifted by the belt.



The flanks have a lot of material perpendicular to this force, so did not see any distort. The edges of the flat part, therefore, also do not distort. The weak point of the buckle is its face. Making it thicker would reduce this bending. There is no need to make the flanks stronger.

The round bar contacts the edges of the flanks in a small area. This concentrated the force and dented the aluminum. The flat bar distributes the force over a much larger area.

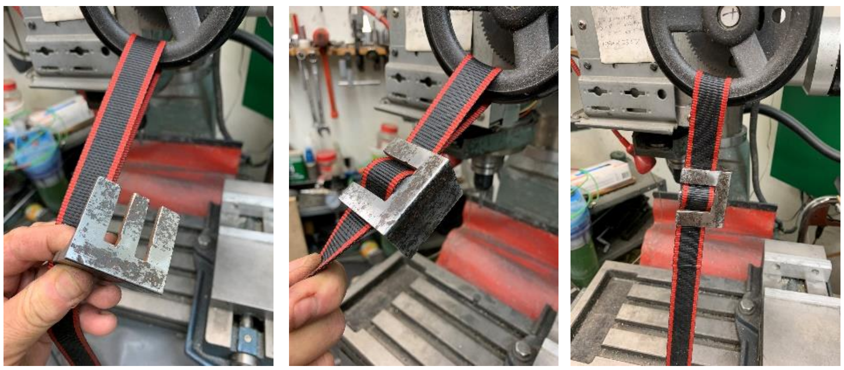
What's next? This weak little buckle is more substantial than I need. I will wait for a real application and see what else I can learn. Going to 1/8-inch thick aluminum channel is attractive. Steel seems unnecessary.

After the initial posting, I received an email from Gregg Kricorissian. He suggested that the bar be replaced with a piece of angle so it would not fall through. Funny thing – I misread his posting and thought he was suggesting using angle for the entire buckle. Neat idea!

My first try was with 1/8-inch thick aluminum. It worked, but the center finger bent a little and took a set.

I then made a second buckle with ¼-inch thick steel angle. The finger side is 1¼-inches long, and the other side is 1-inch long. You can see the large fillet in the corner. It plus the non-finger side of the buckle do a good job of anchoring the fingers.

Here you see the new buckle in my test fixture. The belt is as tight as I can make it. The fingers do bend a little bit when the tension is removed, they return to their original position.



I ran my loop, slid on the clip, and applied tension. With the tension released, the heavy buckle remained in place. Yet I can easily lift it off of the strap by compressing the loop below the buckle.

Collaboration on a design is a powerful thing, even when an idea is misunderstood.

When Gregg saw the above pictures, he suggested looping the working end back into the buckle for added security. He is one smart guy!

I welcome your comments and questions.

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