

Report on Durability of Perforated Sheet Steel when Damaged by Metal Penetrators

By Warder Kevin O'Shaughnessy of the Midrealm

(Note: This paper was originally part of a series of e-mails sent during some serious discussions about Rapier Helmet Safety)

The discussion of the day dealt with the relative safety of the "Standard" perforated steel sheet approved by the SCA for usage in Rapier Helmet Faceplates. Some people were proposing that a broken Foil could penetrate a significant depth through the 1/8 inch holes in the faceplate, partly through deforming the holes as it "wedged" it's way through. I chose to try to simulate a sort of, well not "worst case" but at least "pretty bad case test on a piece of perforated sheet steel I had available.

Greetings Spadacinni!

Note: Not entirely Scientific test ahead!

While on my lunch time here at work I took a piece of 22 ga (about .030 inches thick) perforated stainless steel and took a few thrusts at it with a sharpened 304 stainless steel rod. The rod is .156 inches in diameter and the sharpened taper is about 1/2 inch long. The steel has the SCA standard dimensions for the perforations, but is WAY too thin to be a faceplate. I figured it would be weaker and more likely to fail.

Note: I do not have easy access to any mild steel perforated in the appropriate manner in order to try this with the material that is under question. Also, the sharpened rod I used is round and doesn't have "corners" that can act to concentrate the force and increase the odds of perf steel failure. It also doesn't represent the "2 inch long narrow break " that Don Phillip mentioned. I will see what I can do to simulate that later.

Don Phillip Bell had mentioned that Homologated Epees could break near the tip in a very jagged, splintery and narrow profile that could fit through the 1/8 inch diameter holes in the "standard" SCA perforated faceplate for a rapier helmet. Since the Middle Kingdom is "Heavy Rapier" only this problem doesn't greatly concern me. Also, the past history of Rapier Helmet usage in Kingdoms where Foils and Epees are used doesn't indicate that a problem is in the offing.

Anyway, having mounted the 7 inch long sharpened steel rod into a file handle so it protruded about 4 1/2 inches I placed the perforated steel onto a shallow cardboard box placed on our workshop table. I took a couple of light practice jabs at the steel, in the manner of a "broken foil punch test". No visible damage. I then took a two-handed grip on the handle and stabbed the steel very hard. Three times. The last time with my feet leaving the floor. I bend the steel rod on the third try. In all three stabs, the mesh

bent, but the rod did not penetrate more than about 3/8 inches. If it had been a faceplate I would have collapsed it, but since it was supported by the cardboard box the load was mainly concentrated on the hole where it penetrated.

I would not want this material to be trying to protect my face, but I could not make it "fail" in the classic sense. At least not with a round penetrator. I will try a small file as a "square" penetrator when the opportunity presents itself.

I am attaching pictures to this. I will also e-mail them to Purple so he can place them on the Midrealm Rapier site for everyone to see (those who can't get attachments).

More to come.

Kevin O'Shaughnessy

Hello again, Spadaccini!

I was waiting for some ceramic cement to cure, so I got to make a "cornered penetrator" test in the perforated steel (Yes, I DO like banging pieces of steel together - I AM in the Sidesword program!).

The penetrator was made from an old square file, sharpened to a scary point. The file cross section is about .160 inches square. The taper to a point is again about 1/2 inch.

Same way-too-thin perforated stainless steel. I hit it in different spots.

I hit it with two BIG thrusts, the second one with my feet leaving the ground. I apparently hit it harder than last time, because the whole piece bent some (indicating the cardboard box collapsed somewhat).

Result, one dented hole with corner notches in it, and one hole slightly more deformed, where I missed the hole completely, and the tip dug into the steel and tore a tiny chunk off until the tip could slip INTO the hole. In neither case did the penetrator go deeper than 3/8 of an inch through the hole. In no case was the penetrated width greater than 1/8 inch.

My thoughts: I still cannot speak for a blade break where a substantial portion of the tip is narrower than 1/8 inch. I do personally believe that you would have a VERY difficult time tearing or deforming the perforated steel in order to pass a broken blade larger than 1/8 inch to a great depth. If the people making faceplates use no steel thinner than 18 ga. (.0478 inches thick), either mild or stainless, it is my opinion (worth the price of a bucket of warm hamster vomit), that they will be okay. Stainless

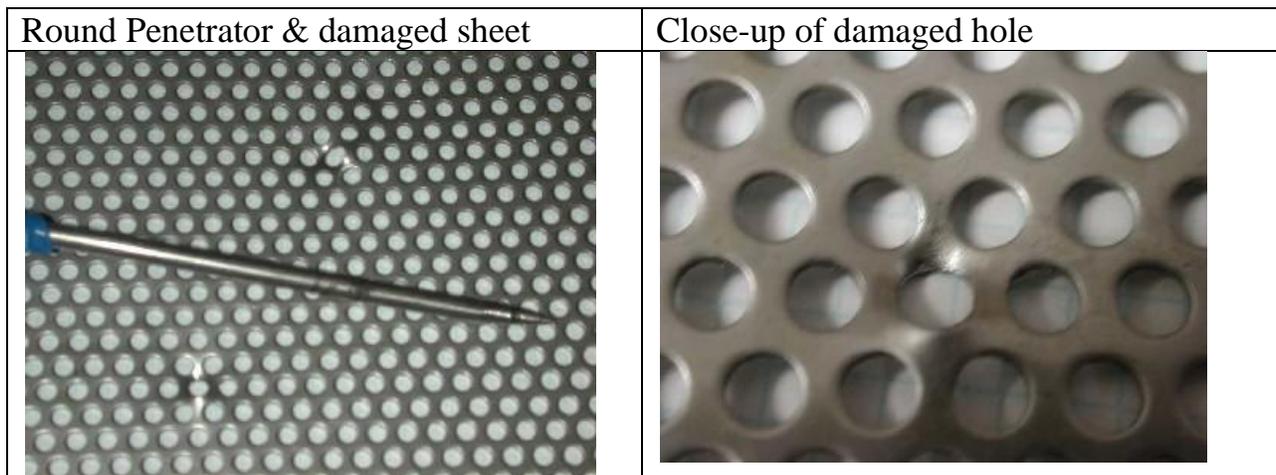
is better. And I built mine with perforated stainless steel where the holes are .094 inches in diameter ;-).

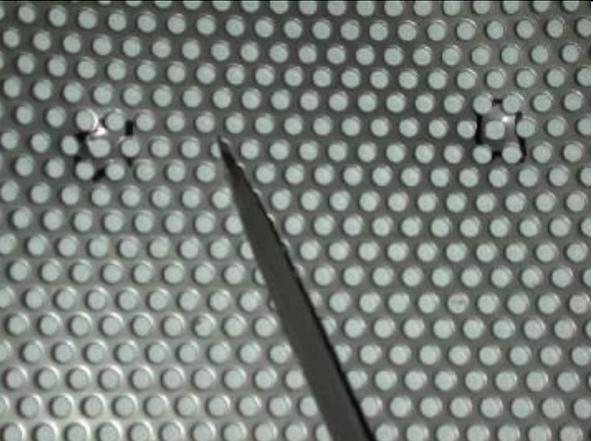
I'd still like to try with real epee blades, but I'd have to do that at home. OSHA, ya' know.

I'm still going to do some more thinking on the whole "faceplate-brim" issue that Don Philip mentioned. I do not agree with him, but I need to order my thoughts more carefully.

Don Philip had expressed concern that the tip of a foil or epee could become effectively lodged at the interface of the brim and faceplate on a rapier helmet. He theorized that this could result in a blade breakage close to the tip with the broken tip being jammed into the faceplate. My thoughts on this are that the odds of occurrence are very small, and the possibility of figuring out where the break would actually occur at is almost non-existent. As I stated earlier, several SCA Kingdoms allow both Rapier helmets and foils/epees, and haven't had that reported yet. The best way, in my opinion, to solve that problem is to do away with epees and foils in SCA combat.

Kevin O'Shaughnessy



<p>Close-up with tip poking in damaged hole</p>	<p>Square penetrator and damaged holes (marked)</p>
	
<p>Hole showing where penetrator damaged sheet steel before entering hole. Note flattened tip on penetrator.</p>	
	