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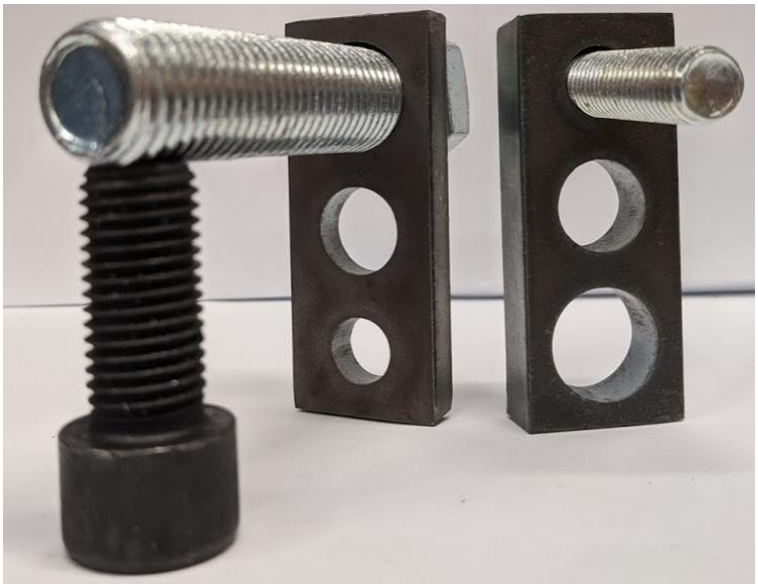
The Reality of Plasma Cut Holes

Plasma cutting in recent years has seen several hole cutting "technologies" emerge, all claiming to be able to plasma cut holes down to 1:1 ratio (hole diameter to plate thickness) and sometimes even less. All while achieving good quality and relatively round cutting. This is most certainly true. However, it is important to understand that the Plasma cutting process is dependent on several factors, to name a few; pierce height, cutting height, cutting speed, gas pressures, current control, consumable degradation, CNC machine type and condition etc. Suffice to say, when cutting holes (especially as the diameter approaches 1:1) the result can be surprisingly inconsistent. This is despite latest technologies that use tried-and-tested parameters to achieve a "True" hole…

Profile Cutting Systems use XcelCut™ technology that enables the use of finely tuned parameters to produce exceptional hole cutting quality. The techniques used in this technology allow for results that are at the very forefront of the Plasma Cutting industry, yet here we are with the honest truth about plasma cut holes – a truth which is often overlooked by customers looking to invest in a cutting machine. By no means are we trying to denounce the ability to plasma cut holes. Our aim is to inform potential buyers so they better understand what it actually takes to achieve the hole cutting that is often advertised to them by equipment manufacturers, often in the form of cut samples, photos and videos.



Xcelcut™

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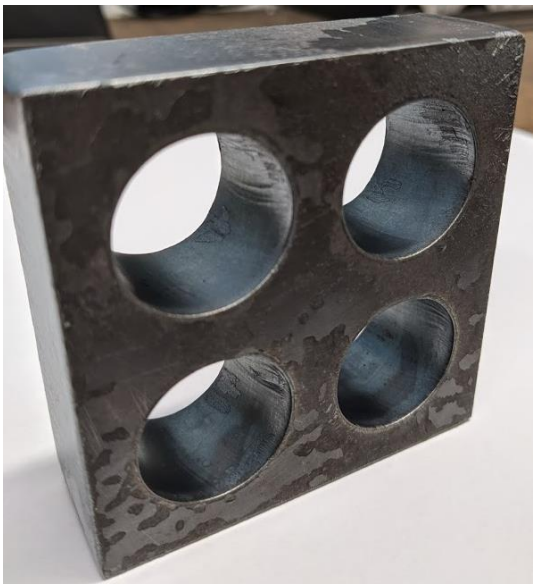
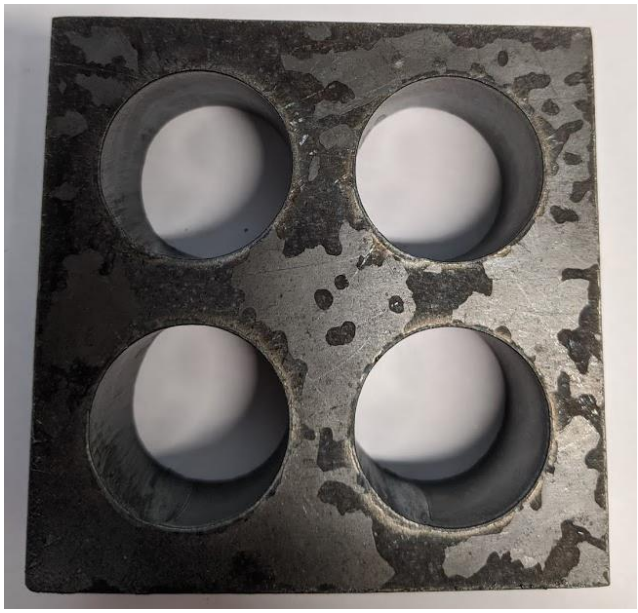
For example, the below 80mm x 80mm part was cut on a PCS Heavy Duty series machine with a High Definition plasma system. It is from 25mm Mild Steel and has 25mm diameter holes (1:1).

TOP SIDE



TOP SIDE

TOP SIDE



TOP SIDE

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BOTTOM SIDE

The most honest presentation of a plasma cut hole is its bottom side. Here is traditionally where plasma has earnt the least respect when cutting holes. But as you can see, it is possible to cut respectful holes using a High Definition plasma system and a flavour of cutting technology – in this case PCS XcelCut™.

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So, what does it take to reliably repeat this hole quality? Let us answer this by explaining how this part was produced.

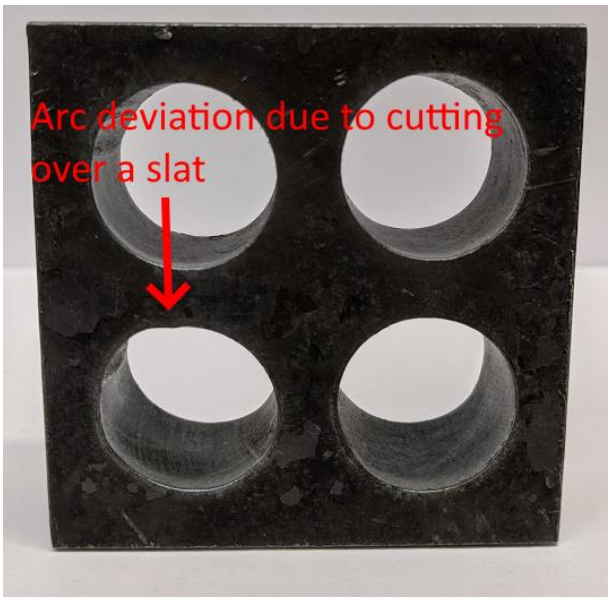
Firstly, in thicker material (such as our sample shown) the holes needed to be pre-pierced. This is because the molten metal (a.k.a SLAG) produced while piercing spreads into what will be the cutting path to produce the hole. When the plasma torch cuts over slag, the plasma arc can deviate slightly and effect the roundness of the hole, notably on the bottom side.

The solution is to pre-pierce and then manually remove the slag. The torch can then Edge Start on the already pierced hole which will produce no slag build-up and therefore cut the hole unimpeded by slag.

After Slag has been Manually scraped off




The next issue is more difficult to overcome. And that is; when the hole is positioned over a cutting slat. This will also deviate the arc and can have a significant impact on the roundness of the hole. For example, the below photos show the effect of a cutting slat that was positioned underneath one of the holes.



Top Side

Bottom Side

This phenomenon is a result of the significantly reduced cutting speed which is a critical factor in good quality hole cutting. However, the down-side to cutting so slow is that the plasma arc is struggling to keep attached to material (remember, it is an electric arc). When cutting over a slat, part of the arc will try and attach to it and therefore deviate from desired cutting path. As shown above, this can result in a less-round cut hole.

And finally, due to significantly reduced cutting speed, dross build-up will occur on the bottom side of the hole requiring a secondary process to clean it off.

Bottom Side Dross

The reality of plasma cut holes can be summarised simply; Good quality, relatively round holes can be achieved thanks to latest technology cutting techniques and modern High Definition Plasma systems coupled to high end CNC machines. However, achieving this consistently is extremely challenging and most often unpractical. Is it therefore prudent to expect *every* plasma cut hole to be as good a quality as what is often seen in equipment manufactures cut samples and other advertising paraphernalia?

Plasma cut holes will always have a place in the metal processing industry, but its fundamental limitations require a realistic understanding of what to expect from your machine in a production environment.