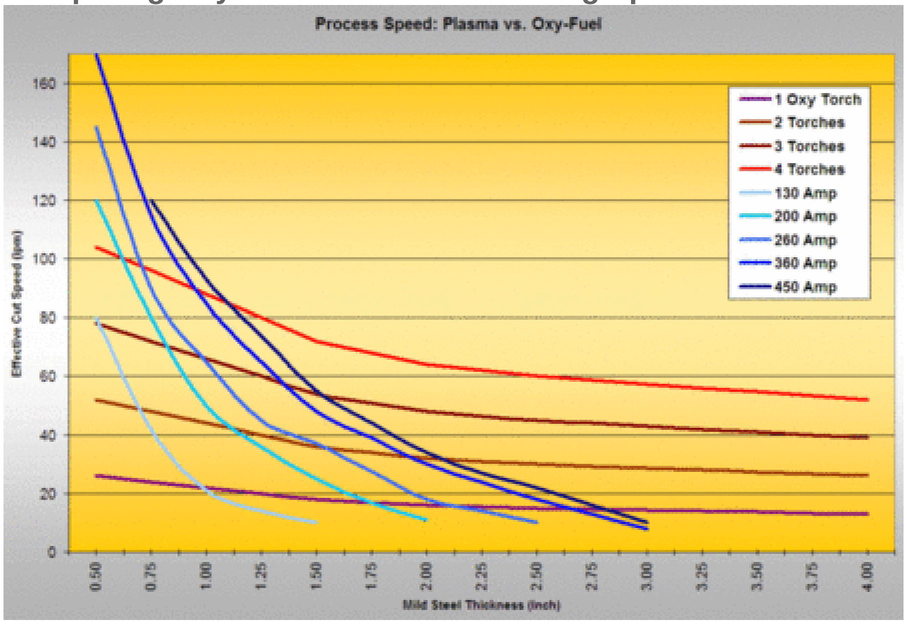
Comparing Oxy-Fuel and Plasma Cutting Speed



I wanted to take a data driven look at the two processes, to see if there was an obvious cross-over point where one process makes more economical sense than the other. To do that, I charted industry standard cutting speeds for the range of mild steel plate thickness between 1/2 inch and 4 inch, since that would be more than enough to cover the entire range that can be handled by both processes.

Nobody is going to argue against the obvious choice at either end of that range, so the cross-over point should lie somewhere in between.

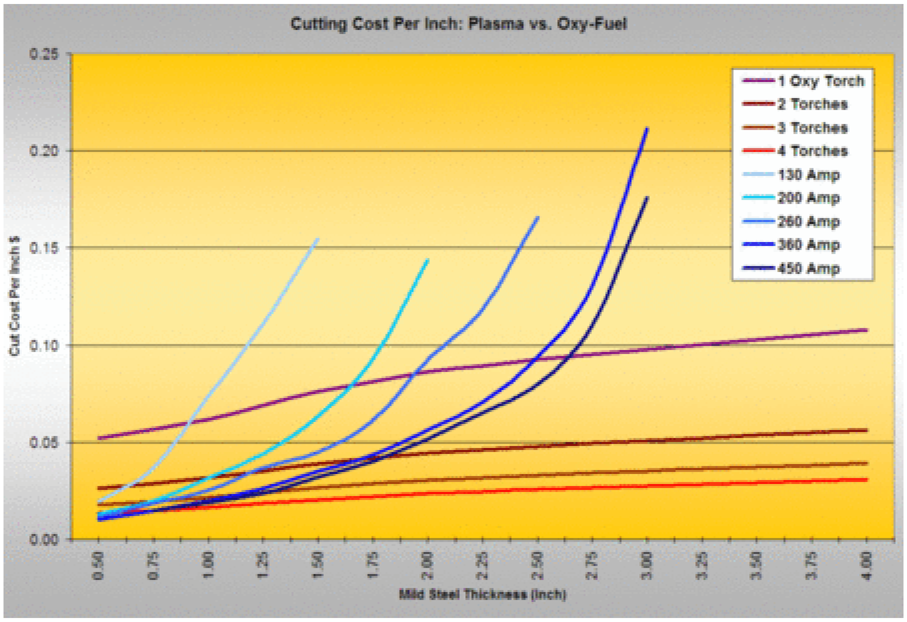
To be as helpful as possible, I needed to include a wide range of different plasma system capabilities, so I included 130Amp, 200Amp, 260Amp, 360Amp, and 450Amp, since these are the most common current ratings of common plasma systems available for CNC shape cutting today. To be realistic, I also needed to consider the effects of cutting with a single oxy-fuel torch as well as multiple oxy-fuel torches. But to keep the graph from getting too cluttered, I limited the comparison to only 1 through 4 oxy-fuel torches.

The result is the chart below, which plots the cutting speeds of five different plasma systems versus the equivalent cutting speed of cutting with 1 oxy-fuel torch, 2 torches, 3 torches, and 4 torches.

Based purely on cutting speed, it looks as if plasma is faster than a single oxy-fuel torch all the way up to 2.75 inches. When you consider cutting with 2 oxy-fuel torches, that drops back to 2 inches thick. If you go all the way up to 4 oxy-fuel torches versus a single plasma torch, oxy-fuel wins at 1-1/8 inch and thicker.

Several things can be learned from this: 1) the old tradition of a 1 inch cut-off for plasma still holds true if your parts lend themselves to being cut with at least 4 oxy-fuel torches simultaneously, and 2) there’s no beating plasma for speed on anything under 3/4 inch thick, even with only 260 Amps versus 4 oxy-fuel torches.

But we also need to keep in mind that so far we are only comparing speed. So let’s throw in a few more variables and see what happens.



Comparing Oxy-Fuel and Plasma Cost-Per-Inch

In the next chart, I added calculations that take into account almost all of the costs associated with each process. For plasma, this included electrodes, nozzles, shields, retainers, baffles, and torch coolant, as well as electricity, oxygen, and compressed air. For oxy-fuel, this includes internal and external nozzles, fuel gas, and oxygen.

When each of these costs is totaled up for each thickness of plate, and then divided by the cutting speed for that plate, we wind up with a “cost-per-inch” value that can be compared. The resulting graph is below.

In this graph, everything is upside down. That’s because now higher cost is up, which means lower numbers are better. Interestingly, this shows that a single oxy-fuel torch is less expensive per inch than 450 Amp plasma on anything over about 2-5/8 inch thick, and cutting with four oxy-fuel torches is less expensive per inch all the way down to about 3/4 inch thick – almost the same results as when we looked only at the speed!

But so far these numbers don’t tell the whole story. For the final chart below I’ve added calculations that take into account the cost of labor, as well as the additional time required for piercing with oxy-fuel and plasma, and applied it to a sample part.

Comparing Oxy-Fuel and Plasma Cost-per-Part

For the purpose of this comparison, I looked at a number of different part sizes, with different numbers of pierces. I also plugged in a variety of different numbers for cost-per-hour of labor & overhead. Each of these changes tends to shift the relative position of the oxy-fuel lines up and down relative to the plasma lines, which are less impacted by these numbers because of the higher speeds and significantly shorter preheat/pierce times. I settled on a part that has 288 inches of cutting, with 10 pierces (a 36” flange with 24” ID and 8 ea. 4” holes). For the hourly labor & overhead rate I used $80/hour.

In the resulting graph, below, again the cross-over point for a single oxy-fuel torch versus 450Amp plasma is just below 3” thick. But the point at which 4 torch cutting becomes less expensive is shifted up over 1 inch.

Now to be fair, the most accurate comparison is going to be done by you, the customer, when you use your own numbers for your actual costs, and plug in the actual length of cutting and number of pierces for some of your own parts.

There are also several other important considerations to mention before I conclude. First, plasma doesn’t handle production piercing over about 2 inch thick. All plasma speeds above

2 inch thick were included, but are based on edge starting, not piercing. Therefore, 2 inches is really the practical cut-off point for plasma, even though it can cut thicker. Second, to keep the graphs from getting too crowded, I did not try to compare the impact of running a machine with 2 plasma torches. But obviously, if the effective plasma speed doubled, the results would blow away oxy-fuel cutting.

Conclusion

Now to bring this to a close, I'd like to stick my neck out and propose a new "tradition". What I suspect most people are looking for is some sort of "rule of thumb" they can use in day-to-day decisions, when deciding whether a part should be sent to a plasma cutter or a burning machine. So based on what I've seen after playing with the numbers in this spreadsheet for quite a while, here's what I would suggest:

- Regardless of what size plasma you have, use plasma for anything up to your maximum production piercing capacity, up to 2 inch thick.
- Use oxy-fuel for everything over 1 inch thick if it has only 1 or 2 pierces or can be chain cut, and can be cut with at least 4 oxy-fuel torches. Otherwise, use plasma.

I hope that helps anyone looking for some guidance with this age old question. But please feel free to poke holes in my logic or comment with your own experience.

Differences in Kerf Width Between Different Processes