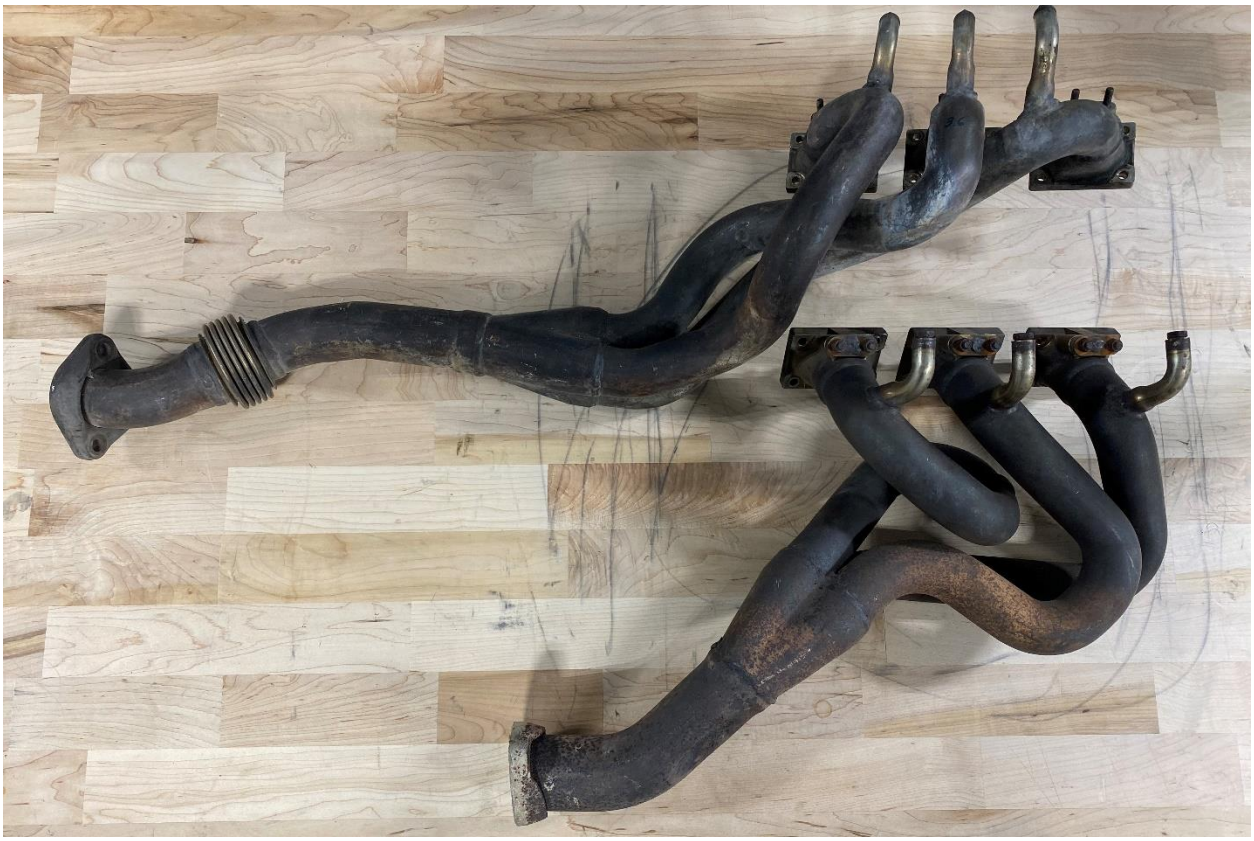
Tech Tuesday

S38 Inconel Myth Part 2 | June 2020



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Angry Ass

From all of the asses at Angry Ass, thanks for joining us on this Tech Tuesday! If you haven't read Part 1 of this Tech Tuesday, then you're behind already and need to get caught up to properly nerd out here.

Here is a recap in case you have forgotten Part 1 or (gasp) don't want to do your homework (skip to the **bottom** if this is redundant). In Part 1 of this Tech Tuesday series, we compared the alloy used in the S38B36 header to a few reference standards, using an industry-standard XRF (X-ray fluorescence) analyzer. The XRF provides a handy way to examine the elemental makeup of the three known Inconel alloys and six different grades of stainless steels, and compare them to the makeup of our S38B36 header section. Put simply, if the B36 header section was Inconel, it would have a dominant elemental makeup of nickel (Ni). If it was made instead with a grade of stainless steel, it would have a dominant elemental makeup of iron (Fe). Inconel may be a rocket-building material, but this ain't rocket science.

Long story short, the S38B36 header sections are not Inconel, and are most definitely a grade of stainless alloy. But, this was more of a baseline as no one ever claimed the B36 exhaust contained Inconel.

Now on to Part 2, where we again scan the S38B36 header section, a few standards, and most importantly a S38B38 header section sourced directly from the Bavarian Halls of Valhalla. Why the B36 unit again? Greg didn't like the LE readings from the last scans, in which the fact that wood = carbon was reiterated for our dumbasses – we wanted cleaner scans for the B36. We also decided to take some measurements to help you decide if BMW did a good job upgrading the header for the S38B38 compared to the S38B36. Bigger is better.

Now that we're done pontificating about your short attention spans, let's get to it. As always, you can skip to the last page for instant gratification – sometimes we like that too!

Angry Ass

Figure 1 shows an S38B36 header section (top) and an S38B38 header section (bottom/ass).

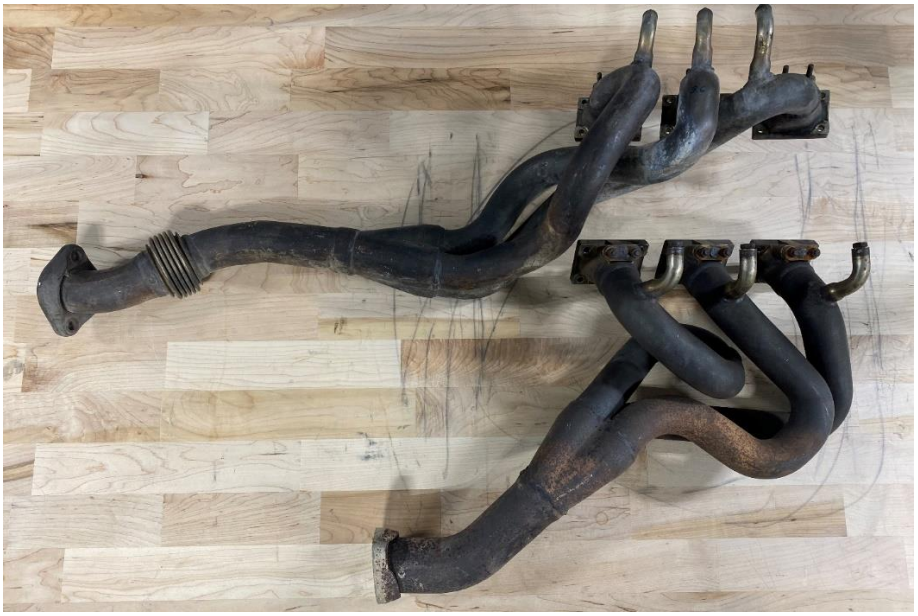


Figure 1

Our first measurement was the S38B36 header to get a nice baseline (see Figure 2).

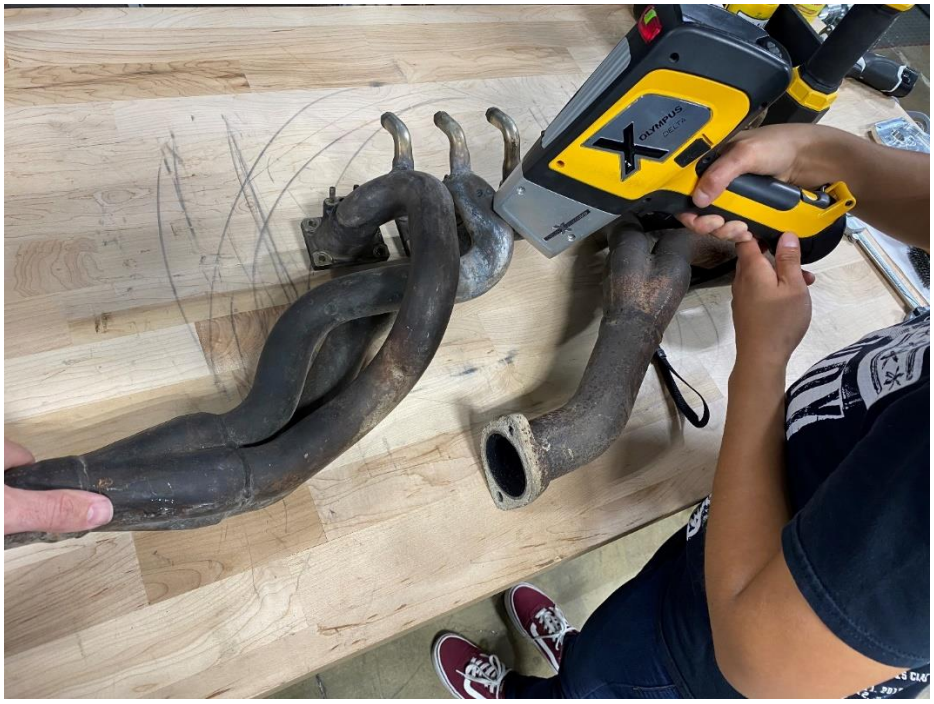


Figure 2

The elemental composition of the S38B36 header is shown with NO contamination from the table in Figure 3. Yeah, that makes Greg happy!

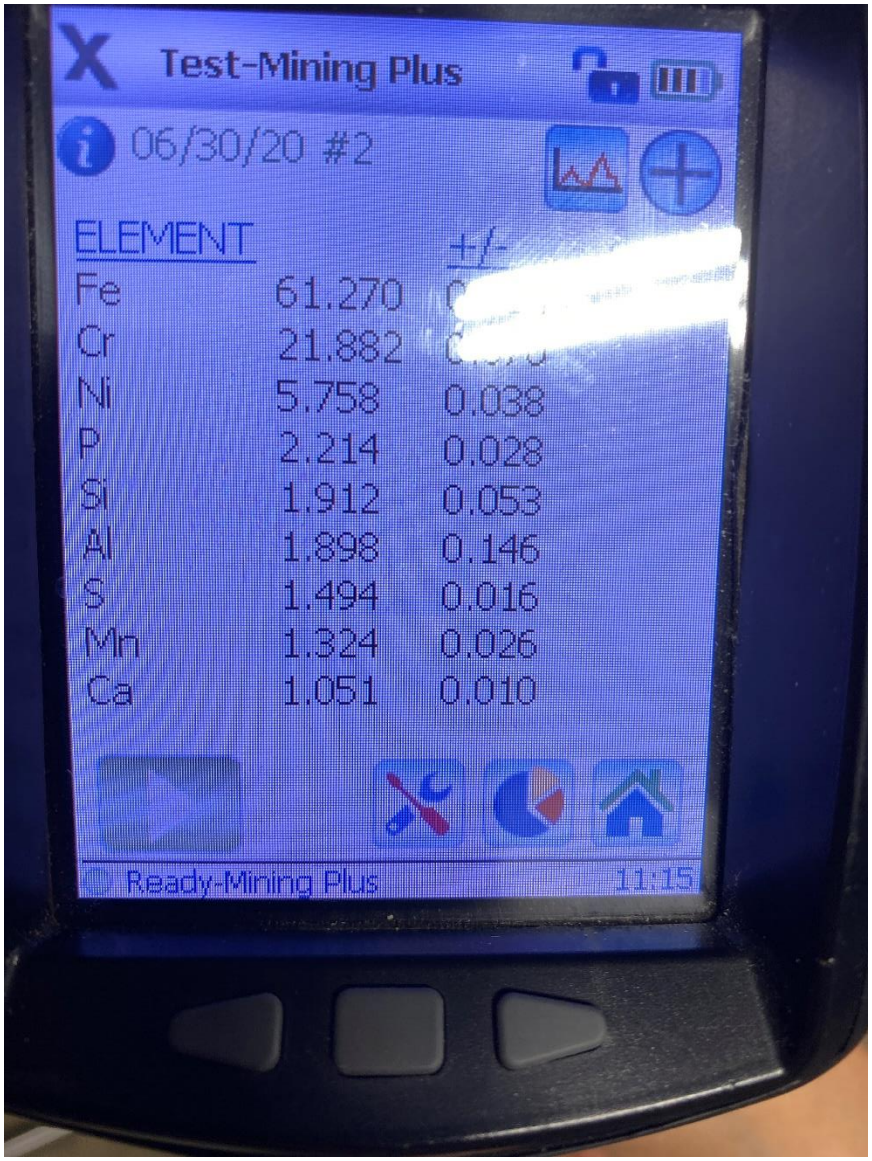


Figure 3

Notice that in Figure 3, the dominant element of the S38B36 header is iron (Fe) with a mixture of chromium (Cr), followed by nickel (Ni). This is consistent with our findings in Part 1 and indicates that the header is constructed of a stainless alloy. To keep things in a logical order, our next scan was the 304 stainless steel standard, in Figure 4.

Figure 4

Figure 5 shows the XRF reading and elemental composition of our 304 alloy standard. Again, notice the dominant iron (Fe) content followed by chromium (Cr) and nickel (Ni).

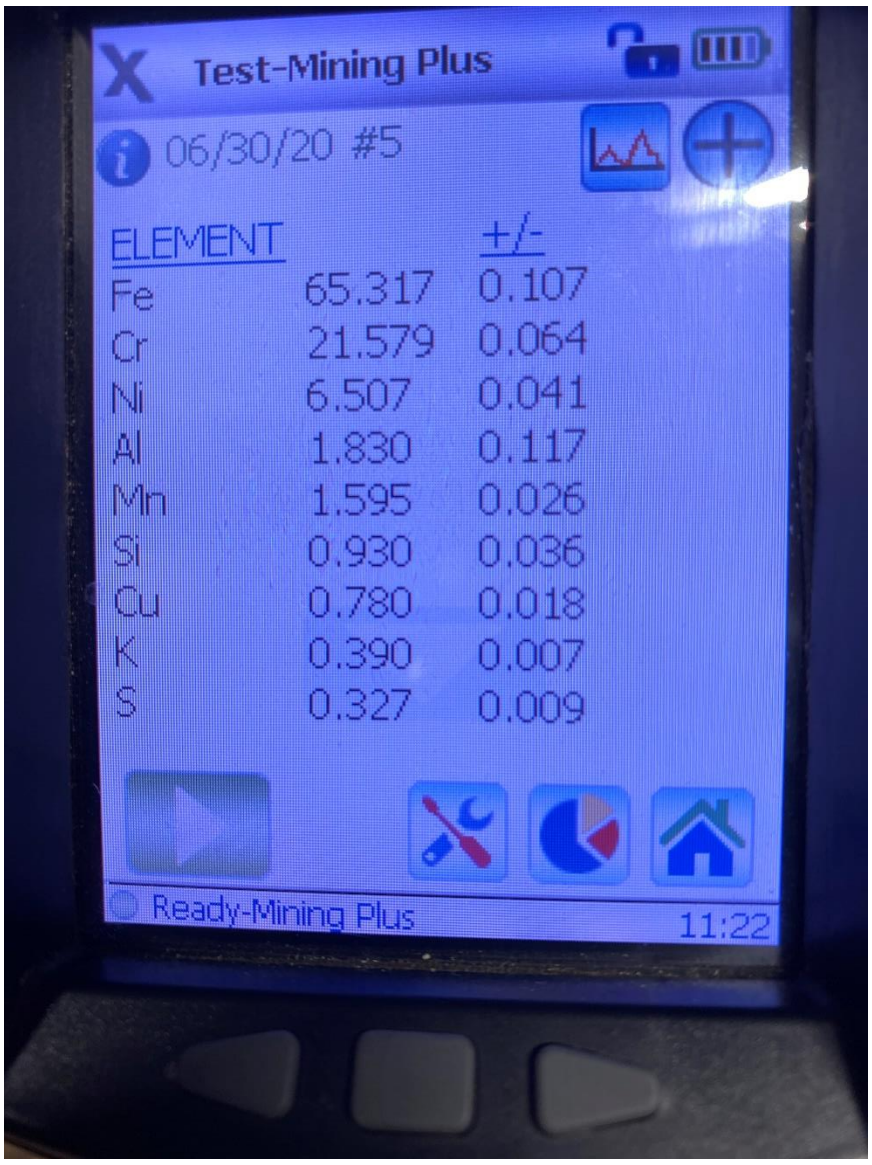


Figure 5

Our next standard for comparison was 321, which is typically used in more extreme environments and differs from 304 in that it is alloyed with titanium (Ti). Figure 6 shows the 321 standard, officially Sharpied.

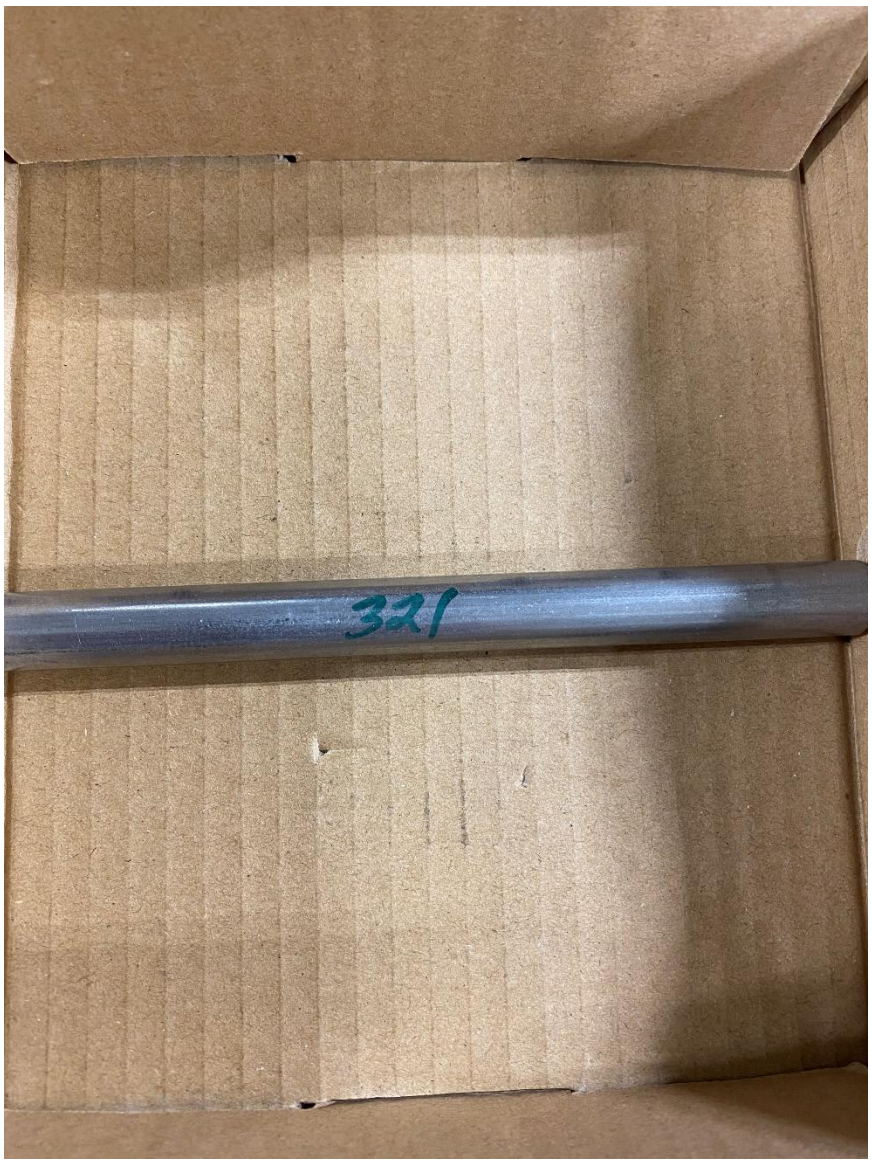


Figure 6

Figure 7 below shows the 321 scan. The major difference from the 304 standard is the addition of titanium (Ti) – told ya so!

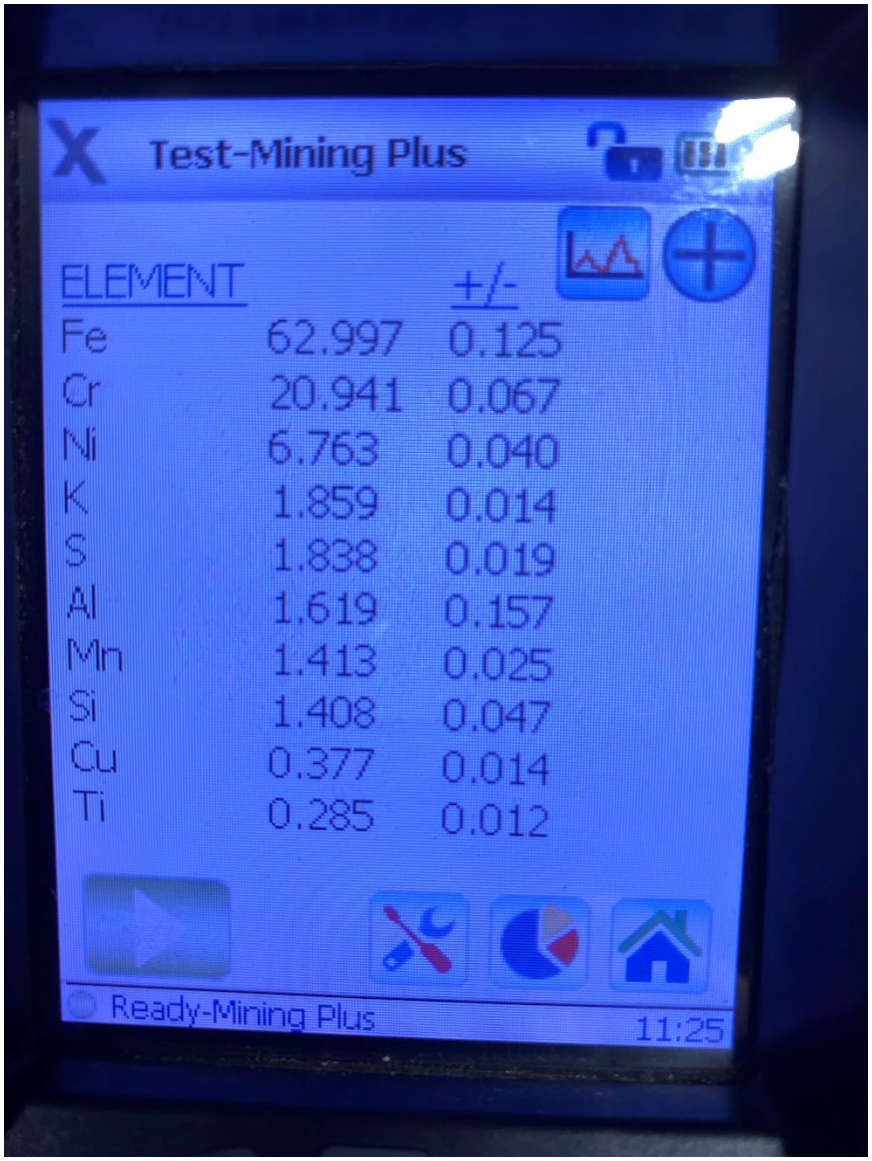


Figure 7

Our final standard to sample was Inconel (Pyromet) 625, which is a typical high-performance exhaust and turbine material, shown in Figure 8.

Figure 8

Figure 9 shows the analysis of the Pyromet 625 standard and makes a clear point of what makes a nickel super alloy: the predominant nickel (Ni) content.

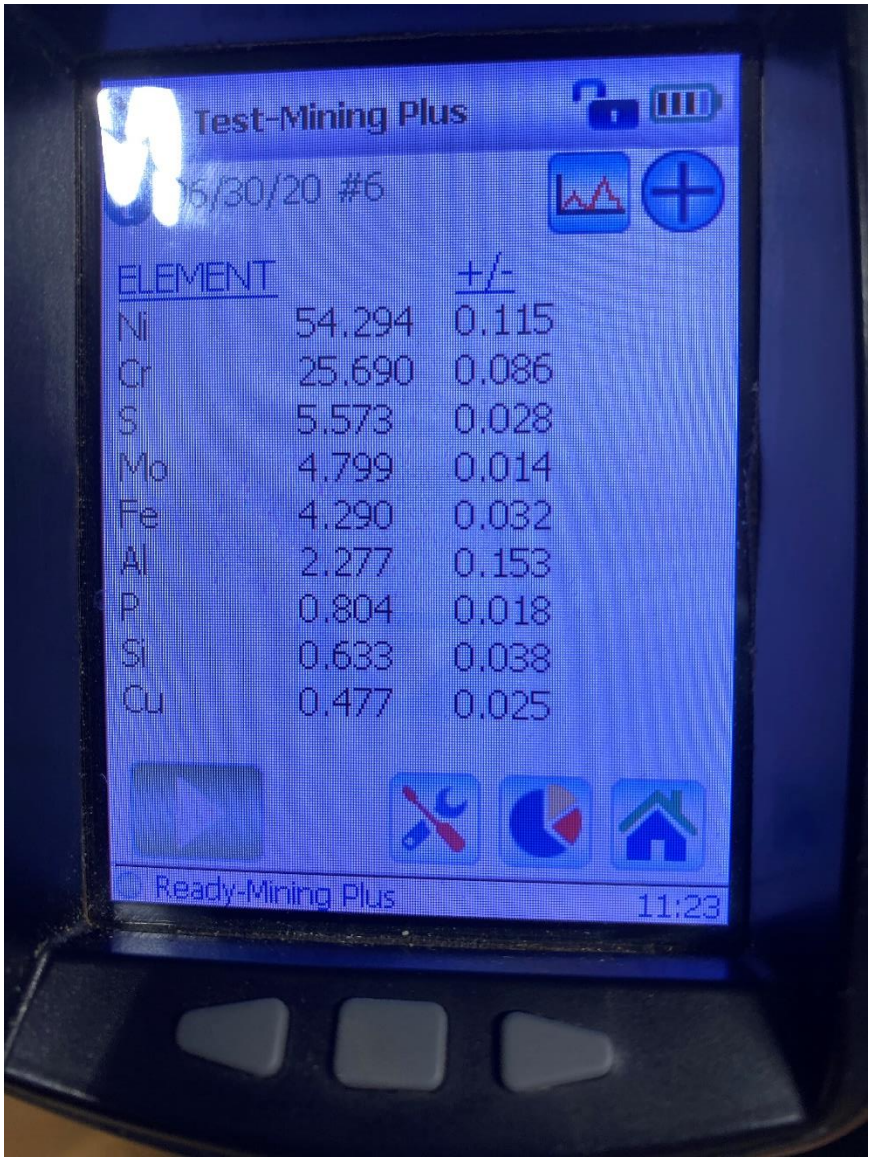


Figure 9

With all of the standards covered, it was time for the main event: the reveal of the Inconel Myth. Will the S38B38 header set prove to be made from Inconel, or some other high-performance material? Figure 10 shows the B38 header being scanned (not Greg's hand). . .

Figure 10

…Did we mention we developed a secondary air injection system delete that allows you to maintain the stock AC compressor and provide proper tension? Why would you bump on and run a lawn mower belt on a car meant to do 155mph + ? Yes, it might work for a bit, but you never know when that compromised hack is gonna fly off the pulleys causing underhood damage or worse, an overheated and crabby significant other! Also, those probably aren't our SAI delete plates you see for sale outside of our site; ours are thicker and better and unlike reusing the stock parts ours don't need holes welded up. So go buy ours . . .

We just thought of this fondling headers over here. We'd call it a shameless plug except we actually do need you to keep buying our parts so we can keep serving this wonderful community!

Oh yeah, on to Figure 11 and the results you're here for.

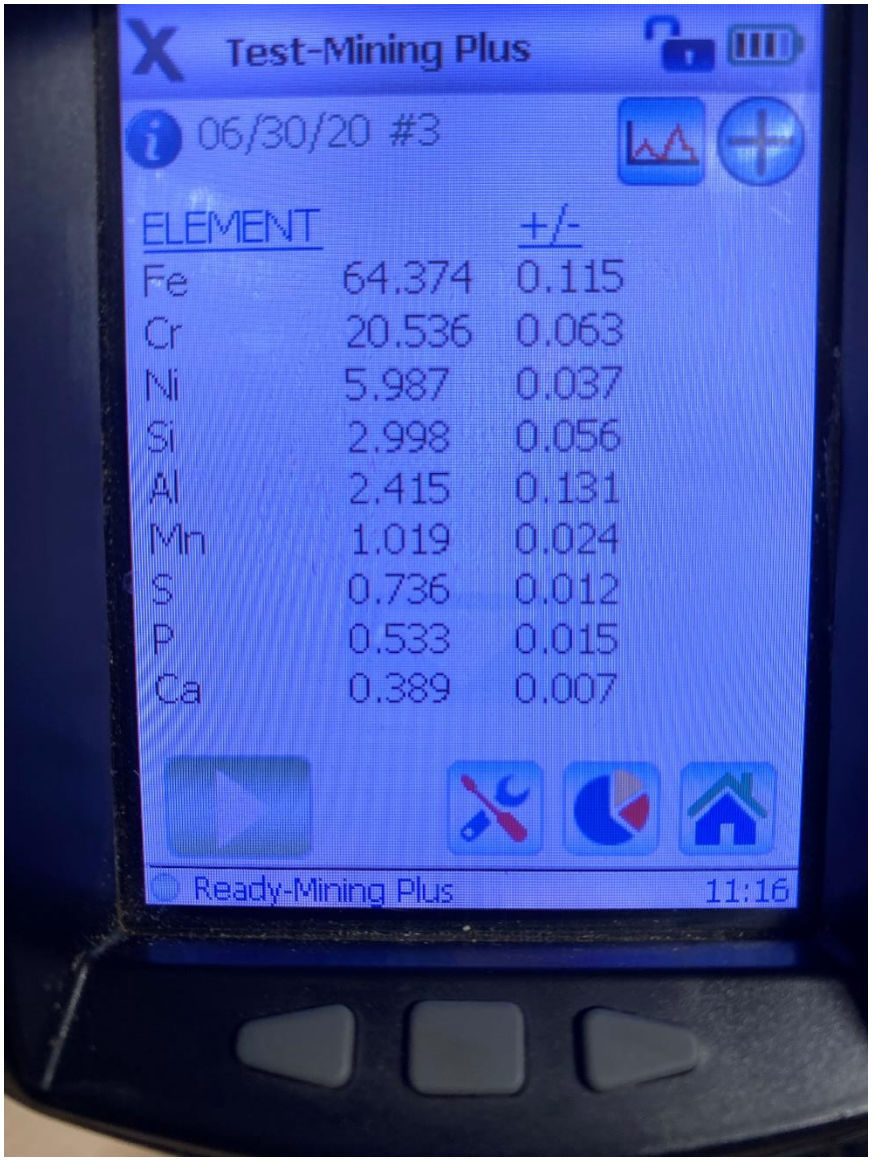


Figure 11

Hmmmmmmmmm…

Figure 11 shows that the S38B38 header has an alloy composition that is dominant in iron (Fe), medium chromium (Cr), and very low nickel (Ni) – just like the S38B36 header. As we have hammered into you, if the header was made from Inconel, the dominant element would be nickel (Ni). Neither the S38B36 or the S38B38 header are made from Inconel alloys and instead appear to be a grade of stainless steel.

Myth, busted! Oh shit, that might be trademarked…but whatever, we love Mythbusters.

To dive deeper and continue testing your attention span, as we mentioned in Part 1, the B38 and B36 header segments share part numbers. We theorized that they probably consisted of the same materials due to this, but this is only partially true. While neither are a nickel-based alloy and both point to being a grade of stainless, only the Swiss, Austrian, and potentially the Japanese (Based on RealOEM) S38B38 share the same part numbers with the S38B36. Our hypothesis is that this discrepancy is most likely due to the tighter emissions and noise ordnances – which also helps explain the drop in rated power for the S38B38 in those markets.

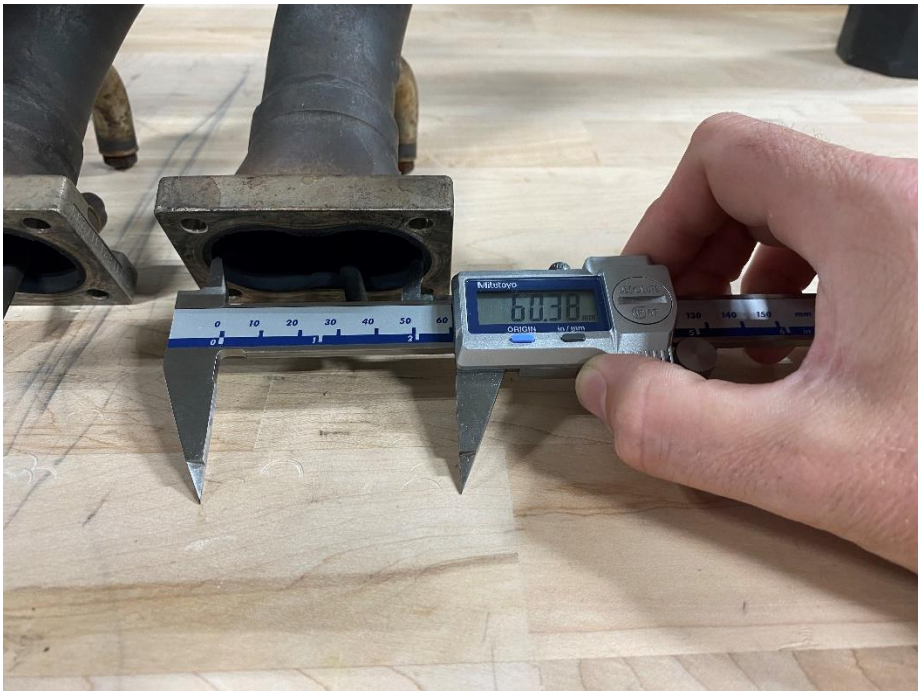
You'd be forgiven for asking yourself, "if the S38B38 header does not have an edge in material construction, then what benefit does it offer?" We found that, as with most things on the 3.8, the headers are bigger, and by a nice margin. Although, the beautiful cast transitions for the head flanges seem to have similar dimensions (see Figures 12 to 17).

S38B36 flange to primary OD, Figure 12

S38B38 flange to primary OD, Figure 13

Notice the same size as the S38B36 unit. Same story for Figures 14-17.

S38B36, Figure 14



S38B38, Figure 15

S38B36, Figure 16

S38B38, Figure 17

Now for the important bit, after the flanges the headers really open up. See Figures 18-21.

S38B36 primary outside diameter, Figure 18

S38B38 primary outside diameter, Figure 19

S38B36 post collector outside diameter, Figure 20

S38B38 post collector outside diameter, Figure 21

In conclusion, while the S38B38 headers may not be a nickel super alloy as once theorized, they're still very nicely designed and fabricated units that represent an upgrade over the earlier B36 part. How often do you see investment in cast stainless head flanges and near-equal length stainless headers on a production vehicle? Much less one with 4 or 5 seats, autobahn civility, and daily driveability? Considering the S38B38 was never brought to the United States – around the same time the decision was made to build a watered-down ///M engine for the North American E36 M3 – it's no surprise that BMW did not take on the additional cost of applying a material such as Inconel to the mass-produced M5's exhaust. But as always, we remain impressed and in love with this car's special motorsport-derived characteristics.

We hope you enjoyed this Tech Tuesday, and we look forward to diving into more details on these amazing cars in future articles. Maybe on topics slightly less mundane!

Thanks for reading!

- Angry Ass