It’s been a wonderful learning journey for me at E.W. Klein over the last few months. I had the awesome opportunities to learn the science and technology behind power generation, paper manufacturing, carpet dewatering, mining operations, all kinds of chemical processing, and a wide variety of general industrial applications. Some of the things I’ve learned have challenged certain assumptions I have made and accepted as universal truth in the past, assumptions such as stainless steel doesn’t hold a magnet.

In my previous job, I have frequently made fun of our Chinese stainless-steel suppliers for providing us inferior raw materials, because they would arrive with magnetized screwdriver tips still stuck to them. While I’m not vindicating the quality of my previous company’s Chinese suppliers, I have learned that some stainless steels can hold a magnet.

Being someone that failed Chemistry 101 almost twice in college, I’ll attempt to explain this in the best way I understood it. Please feel free to educate me further on this topic and forgive me if I’m repeating something you already know, because I genuinely find this fascinating.

Stainless steel can be categorized by their crystalline structure into four main types: austenitic, martensitic, duplex, and ferritic (which is magnetic, and commonly used in automotive applications). For many stainless-steel Nash pumps, we frequently refer to grade 316 as the material of construction. This is an austenitic stainless steel, and essentially non-magnetic. However, methods of construction can have an influence in its physical properties and corrosion resistance. For example, the cast equivalent of wrought 316 material is CF8M. Although the cast and wrought materials are very similar, they are not identical regarding their chromium and nickel content, neither are their metallurgical structures. Where the wrought materials are fully austenitic, the castings will contain some ferrite, or delta ferrite to be terminologically correct, in its basic austenitic matrix. The ferrite content makes the casting easier to weld and work with, because it increases the ductility of the material. It is common to see ferrite level of 5% to 12% in many casting equivalent grades of austenitic stainless steel. At this range, it is possible for the casting to hold a magnet. Cracking might occur at below 5%, and continuous network of ferrite might form at above 12%. Although isolated pool of ferrite doesn’t pose noticeable risk to the material’s corrosion resistance, when they form into a network it can make the material vulnerable to attack in high chloride content environment, resulting chloride cracking.

This is not to say CF8M casting grade stainless steel is not corrosive resistant. This is a very common grade of casting stainless steel material and has been used to handle materials ranging from acetic acid, blood plasma, to sulfuric acids, and vinyl alcohol. In either a Nash stainless-steel liquid ring or stainless-steel dry screw pump application, many parts of the pump are castings, so the general advice is to avoid condensation of high chloride content vapor inside the pumps, or letting the pump sit with high chloride content liquid inside. In certain specialized applications where the pump is processing high chloride content liquid, we have opted to use other materials of construction, such as Hastelloy, titanium, or we worked with our foundry to cast stainless steel with lowered ferrite content.

So, to summarize, here are a few key take-aways:

* CF8M is the casting equivalent grade of 316 stainless steel. It contains higher ferrite, which makes it somewhat magnetic.
* The higher ferrite content of CF8M, and other casting grades of SS, makes the material tougher, so easier to weld and work with.
* The higher ferrite content of these casting grade of SS can also expose them to attack in high chloride environment.
* In specialized applications where a Nash pump is exposed to high chloride content, other specialized metals can be used to construct pumps.

I hope you find this information valuable and useful. I welcome your feedback on this bit of knowledge and this tool of communication. If you have specific questions, similar knowledge to share, disagreement over what I’ve shared, or just don’t want to get these emails anymore, please feel free to let me know. I think I’m pretty thick-skinned, so I can take criticism and challenges of all kinds.

I hope you all have a great weekend and productive weeks ahead!