

## Optimising your stainless steel design

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Whilst the call for minerals processing equipment in stainless steel is not an everyday occurrence, there are instances when stainless is the optimum, if not the only possible, choice. Although relatively expensive at the outset, the return on investment in terms of performance and longevity is soon realised. And given the challenges from the global recession now facing us, it is particularly important to review and consider all options in stainless steel – as there could be significant financial implications if the optimal choice has not been made.

So, although the decision behind integrating a stainless steel design is process-driven and cannot be avoided, deciding on the type of stainless steel offers quite a few choices. This article will discuss the opportunities in stainless steel designs, whilst ensuring the process is not compromised.

### Firstly, when do we use stainless steel?

Taking thickening as an example, a stainless steel design is required when the slurry is chemically corrosive (low pH). Generally, stainless is used only for the wetted components as the non-wet components can be made of cheaper structural carbon steel.



*An Outotec 7.1m stainless steel HCT thickener*

### Types of stainless steel

There are two main categories of stainless steel for mineral processing applications, each of which has a myriad of variations within:

1. Austenitic steel (304, 316 etc) is the more 'traditional' choice
2. Duplex steel (LDX, SAF etc) more 'contemporary' choice. Duplex is made of two phases, austenite and ferrite.

The physical properties of duplex steel are a combination of the austenitic and ferritic grades. Generally, duplex steel offers the same or better corrosion properties than their austenitic counterparts. Also, generally, as duplex has roughly twice the yield strength of their counterpart, less steel is required, resulting in a more cost-effective solution. In terms of chloride stress corrosion cracking (CSCC), all duplex alloys have better CSCC resistance than their 304L, 316L or 317L austenitic counterparts. Pitting is the most common form of corrosion in SS and duplex again outperforms its counterpart here. However, there are some cases where the ferrite phase of duplex is targeted, so a comprehensive understanding of

the process slurry is imperative. As with all key purchase decisions, it is vital to work closely with your supplier, ensure they are involved early and ensure fully comprehensive on-site testwork is performed prior to any final decisions.

### Opportunity #1 - Minimize delivery by completing detail design early

The purchase of equipment, whether stainless steel or not, should be a task that is reviewed with the complete plant design in mind. Considering these conditions early in the design phase can have a significant impact on the plant economics. Changes to issues such as tank arrangements, support structures and piping can cost significantly more if not properly specified and subsequent changes need to be made to the initial detail design. Equally, if further amendments to the size and quantity are necessary, project lead time can be severely affected – particularly if the materials are in short supply. Other factors, such as site ground conditions and horizontal loads, including wind and seismicity, need to also be correctly specified at an early stage.

### Opportunity #2 - Evaluate all factors to ensure real total cost is examined

The capital cost of a stainless steel design is not the only element which needs to be examined. When working with your technology provider, they should outline all the elements which will make up the total cost of a design. These elements include:

**Fabrication** - forming, machining, welding of plates. Thinner plates can take less time and therefore cost less money. However, depending on the type of steel used, contamination is one issue which needs to be carefully monitored.



*Cross contamination from nearby grinding which has lead to rust formation on stainless steel*

**Transportation** – duplex steel weighs less (as less is often required than austenitic). Other factors to consider are the selection of sheet size to optimize transport costs. If the mass of steel is high in comparison to the mass limitation of a standard container, then consider half height containers

**Site erection (welding)** – again, less time is necessary on thinner plates. Also, design for bolting connections can minimize site welding

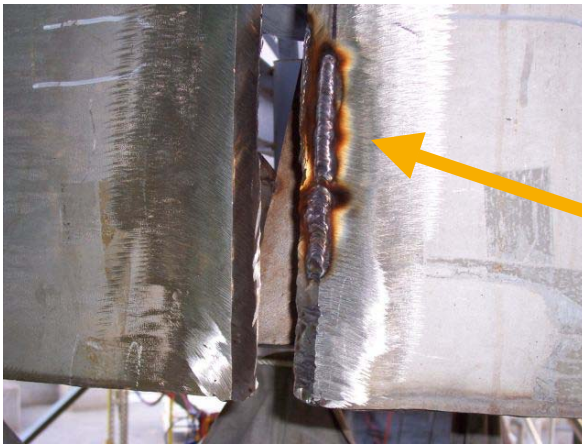
**Structural** – less concrete needed for lighter constructions

**Maintenance** – corrosion resistance is one example here. The longer the lifetime of a structure, the less downtime in service incurred. Another important factor to consider is the accurate specification of personnel and equipment access at site

### Opportunity #3 – Ensure your technology provider has relevant experience and contacts

Relevant experience leads to smarter design solutions and using a technology provider with the right contacts and experience is worth its weight in gold. For one thing, its engineering department will have the experience to provide the best possible design for the project. For example, the provision of nested drawings for the wall and floor (scalped floor offers a good opportunity for cost saving as smart nesting and plate size selection may result in a very low quantity of off-cut material). And having good contacts is another key requirement of your provider – as the following examples illustrate

- Availability of quality stainless steel fabricators is limited, ensure your provider has long standing relationships with fabricators local to your project (more cost competitive)
- Ensure their local fabricators have all the relevant quality and safety certifications. Separate workshop areas are needed for structural and stainless steel fabrication. Special attention needs to be paid to preventing cross contamination.



*Overheating during welding can lead to properties of SS being compromised*

### Finally,

So, whilst stainless steel designs may seem expensive, there are many ways to ensure total costs are minimized, whilst issues such as performance, maintenance and durability are optimized. The key is to ensure accurate and early specification at the detailed design stage, whilst working closely with a supplier who has all the necessary experience and contacts. For any new design there are opportunities to save costs or make expensive mistakes – and stainless steel can offer these opportunities in the extreme.

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