Commercial Building Water Transfer Services: Cast Iron vs. Stainless Steel Pumps

Cast Iron Pump

Stainless Steel Pump

Historically, cast iron has been the material choice for general service water pumps, such as commercial building water transfer services, with initial cost being the primary decision factor. This makes perfect sense for large pumps. However, for numerous reasons, it is not the obvious choice for smaller pumps; 20HP or less.

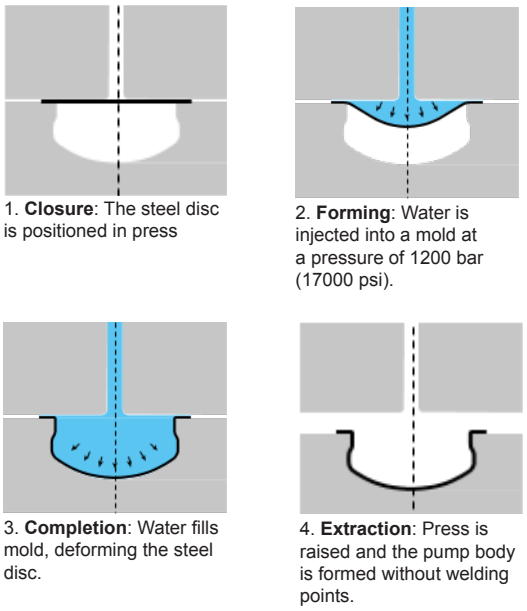
Initial Cost

In the past, both cast iron and stainless-steel pumps consisted of cast hydraulic components. Cast iron was always cost advantaged. Today, the manufacturing processes are no longer identical for both materials. The process has not changed for cast iron, but many pump manufacturers have changed their manufacturing process for stainless steel pump hydraulic components.

The process of bulge forming enables the ability to produce seamless, lightweight, parts. It involves applying extreme pressures in a press that are exerted onto tooling that forms metal parts into complicated dimensioned shapes. This process is widely used to manufacture parts for the aerospace, defense, and industrial markets. EBARA uses this process to manufacture the complex shapes required for stainless-steel centrifugal pumps. When bulge forming is combined with heat treatment and hydroforming, the EBARA process can produce these products to the highest quality standards.

Hydroforming (Figure 1) combines the press force with the power of water. The hydroforming process yields stronger, perfectly smooth shapes, without welding points. These are significant advantages over traditional processes.

Figure 1: Hydroforming Process



1. **Closure**: The steel disc is positioned in press

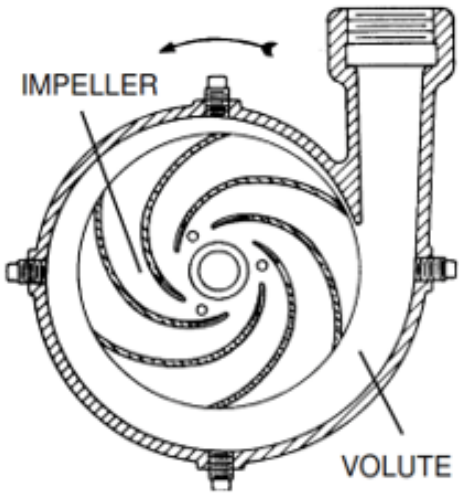
2. **Forming**: Water is injected into a mold at a pressure of 1200 bar (17000 psi).

3. **Completion**: Water fills mold, deforming the steel disc.

4. **Extraction**: Press is raised and the pump body is formed without welding points.

Pump casings have a highly complex shape needed for the volute required to convert velocity energy to pressure energy (Figure 2). Hydroforming results in improved efficiency, high performance, and corrosion resistance.

Figure 2: Volute



Fabrication can also be used to supplement manufacture stainless steel components (Figure 3). In either case the step and cost of machining components to their final high tolerance dimensions can be eliminated.

Figure 3: Stainless Steel Casings

Maintenance Cost

Bulged formed, hydro-formed and fabricated stainless-steel pump components are significantly lighter in weight, which makes pumps of this type easier to handle and maintain. For some sizes the need for cranes to install and maintain pumps is eliminated. Bulged and hydro formed casings create a more uniform product with smoother geometric transitions and eliminates stress risers.

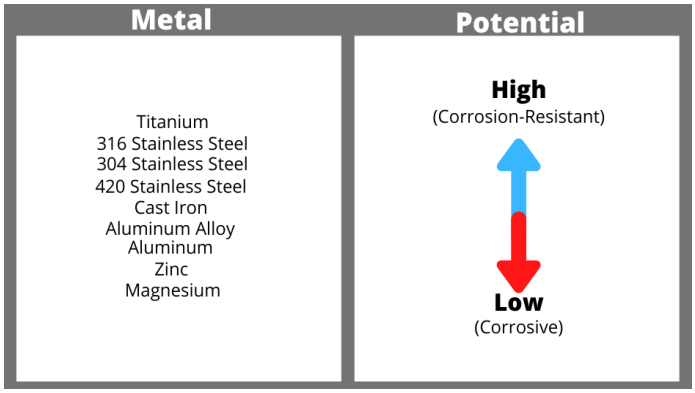
Stainless steel has significantly better corrosion characteristics than cast iron (Figure 4). Corrosion is not necessarily a consideration one might think of when selecting pumps for water transfer services. Let's face it, water is not highly corrosive. However, when it comes to maintenance, virtually zero corrosion is an accurate description for stainless steel, but not for cast iron. Cast iron pump maintenance is routinely complicated during disassembly/reassembly with corroded parts and fasteners being fused together.

Figure 4: Corrosion

Cast iron with its high iron (Fe) content will always rust in water environments. There is simply no escaping this reality. This fact has some unintended consequences. Unlike cast iron components, smoother stainless-steel rust-free water passageways optimize pump efficiency and deters crevice corrosion. Crevice corrosion concentrates in crevices, pits or surface imperfections (porosity) of cast parts. The smoother the surface exposed to a corrosive atmosphere, the better deterrent against crevice corrosion.

All wetted parts in a stainless-steel pump are of the same material (casing, shaft & impeller) which eliminates bimetallic corrosion. Bimetallic corrosion is caused by dissimilar metals with different potentials being in contact with each other. The metal with the lower potential (cast iron) will corrode while the higher potential material (304SS) is protected from corrosion (Figure 5). If a cast iron impeller is mounted on a stainless-steel shaft or mechanical seal gland, the cast iron impeller has less potential and becomes the sacrificed component. Bimetallic corrosion can also be called "Galvanic corrosion".

Figure 5: Corrosion Potential



Conclusion

For equivalent cost to cast iron, stainless pumps for water services provides meaningful advantages including improved maintainability and lower weight, while eliminating problems associated with corrosion. This has led to an accelerated trend towards stainless-steel pumps for commercial building water transfer services.