COMPARISON OF 316 AND 316L STAINLESS STEEL ALLOYS

Type 316 austenitic stainless steel is a commonly used alloy for products that require excellent overall corrosion resistance. Type 316L is a low-carbon modification of Type 316. The following is a comparison of these alloys.

The maximum carbon content in Type 316 is 0.08%. The carbon content is controlled to a maximum of 0.03% in 316L, which minimizes the problem of carbide precipitation during the welding process. If austenitic stainless steels are welded at a high temperature, carbon can combine with the chromium to form chromium carbide in the heat affected zone of the weld. The loss of chromium in the alloy can cause a reduction in the corrosion resistance of the alloy in that area.

Carbide precipitation can be prevented by closely controlling the welding temperature or by solution annealing the parts after welding. Where that is not practical the use of a low carbon alloy reduces the possibility of carbide precipitation.

Except for the improved weldability of the alloy, 316L has similar corrosion resistance and mechanical properties to 316. The exception is that the tensile yield strength of 316L is somewhat less than that of 316 at ambient temperatures. In the ASME Pressure Vessel Code the maximum allowable stress for 316 is 20,000 psi, but it is only 16,700 psi for 316L.

The cast equivalents of these alloys are CF8M (316) and CF3M (316L). In the cast alloys the reason for the reduced carbon is the same as for the wrought alloys. The corrosion resistance and mechanical properties of these two alloys are the same. The Pressure Vessel Code gives a maximum allowable stress of 20,000 psi for each of the cast alloys.

Another difference in the Pressure Vessel Code is that 316 and CF8M may be used at temperatures up to 1500F, whereas the 316L and CF3M alloys are limited to a maximum temperature of 800F. This is generally not a consideration for DeZURIK Water Controls products.

A similar comparison can be made between the standard and low carbon versions of other austenitic stainless steel alloys. For example: between 304 (CF8) and 304L (CF3) and between 317 (CG8M) and 317L (CG3M).

Conclusions:

Use the standard austenitic alloys (316 or CF8M) whenever the part will not be welded or can be solution annealed after welding.

Use the low carbon versions (316L or CF3M) for parts that will be welded and cannot be solution annealed after welding.