As American AISI basic grades, the only practical difference between 304 or 316 and 304L or 316L is carbon content. The carbon ranges are 0.08% maximum for 304 and 316 and 0.030% maximum for the 304L and 316L types. All other element ranges are essentially the same (nickel range for 304 is 8.00-10.50% and for 304L 8.00-12.00%). There are two European steels of the '304L' type, 1.4306 and 1.4307. The 1.4307 is the variant most commonly offered, outside Germany. The 1.4301 (304) and 1.4307 (304L) have carbon ranges of 0.07% maximum and 0.030% maximum, respectively. The chromium and nickel ranges are similar, nickel for both grades having an 8% minimum. 1.4306 is essentially a German grade and has 10% minimum Ni. This reduces the ferrite content of the steel and has found to be necessary for some chemical pro-cesses. The European grades for the 316 and 316L types, 1.4401 and 1.4404, match on all elements with carbon ranges of 0.07% maximum for 1.4401 and 0.030% maximum for 1.4404. There are also high Mo versions (2.5% minimum Ni) of 316 and 316L in the EN system, 1.4436 and 1.4432 respectively. To further complicate matters, there is also grade 1.4435 which is both high in Mo (2.5% minimum) and in Ni (12.5% minimum).

Effect of carbon on corrosion resistance

The lower carbon 'variants' (316L) were established as alternatives to the 'standards' (316) carbon range grade to overcome the risk of intercrystalline corrosion (weld decay), which was identified as a problem in the early days of the application of these steels. This can result if the steel is held in a temperature range 450 to 850°C for periods of several minutes, depending on the temperature and subsequently exposed to aggressive corrosive environments. Corrosion then takes place next to grain boundaries.

If the carbon level is below 0.030% then this intercrystalline corrosion does not take place following exposure to these temperatures, especially for the sort of times normally experienced in the heat affected zone of welds in 'thick' sections of steel.

Effect of carbon level on weldability

There is a view that the low carbon types are easier to weld than the standard carbon types.

There does not seem to be a clear reason for this, and the differences are probably associated with the lower strength of the low carbon type. The low carbon type may be easier to shape and form, which in turn may also affect the levels of residual stress left the steel after is forming and fitting up for welding. This may result in the 'standard' carbon types needing more force to hold them in position once fitted-up for welding, with more of a tendency to spring-back if not properly held in place.

The welding consumables for both types are based on a low carbon composition, to avoid intercrystalline corrosion risk in the solidified weld nugget or from the diffusion of carbon into the parent (surrounding) metal.

Source: BSSA