2. *Comparison of Descaling, Pickling, Passivation and Cleaning*

The terms 'descaling', 'pickling' and 'passivation' are often confused, but are distinct processes. It is important to be clear about the differences between these surface treatment processes as applied to stainless steels.

2.1 Descaling

Descaling is the removal of a thick visible oxide scale from the surface. This oxide is usually dark grey. This process is done routinely in the manufacturing steel mill before the steel is delivered. Mill descaling is usually a two-stage process, one to mechanically loosen the 'mill-scale', the second to lift the loosened scale clear from the metal surface. The exposed metal surface is then usually pickled to remove the metal layer that was immediately beneath the scale. This stage of the process should be considered as a separate one, however.

Although some slight scaling may occur in the high temperature heat affected zone of welds or during high temperature heat treatment processes on fabricated stainless steel parts, further descaling operations are not usually necessary.

2.2 Pickling

Pickling is the removal of a thin layer of metal from the surface of the stainless steel. Mixtures of nitric and hydrofluoric acids are usually used for pickling stainless steels. Pickling is the process used to remove weld heat tinted layers from the surface of stainless steel fabrications, where the steel's surface chromium level has been reduced.

Stainless steel surfaces form a grey/black scale during hot rolling or forming. This tenacious oxide scale is removed in the steelmill by descaling.

A matt grey is left on annealed mill products following descaling and pickling. Mechanical scale loosening roughens the surface.

Light scaling left on weld caps and heat tint on the surrounding parent tube surfaces can usually be removed by acid pickling.

2.3 Passivation

Passivation usually occurs naturally on the surfaces of stainless steels, but it may sometimes be necessary to assist the process with oxidising acid treatments. Unlike pickling, no metal is removed from the surface during acid assisted passivation. The quality and thickness of the passive layer is however quickly developed during acid passivation treatments. There may be circumstances when the pickling and passivation processes occur sequentially (not simultaneously), during acid treatments involving nitric acid. Nitric acid alone will only passivate stainless steel surfaces. It is not an effective acid for pickling stainless steels.

2.4 Cleaning

Acid treatments alone cannot be relied upon to remove oil, grease or inorganic contaminants that can also prevent the passive layer forming properly. Combinations of degreasing, cleaning, pickling and passivation treatments may be necessary to fully prepare machined or fabricated stainless steel surfaces for their intended service conditions.

If stainless parts are contaminated with grease or oil, then a cleaning operation prior to acid treatment should be carried out.

Patchy, uneven pickled surfaces can result if surfaces are not clean before the acid treatment.