

# STAINLESS STEEL: AN INTRODUCTION & GUIDE TO WELDING

## WHAT IS STAINLESS STEEL?

Stainless steel is a generic term for a range of steels that contain a minimum of 12% chromium, although other elements such as nickel and molybdenum are added to improve corrosion resistance, which is their primary feature and use. Stainless Steels are grouped primarily into four classes depending on their crystal structure; austenitic (302, 304, 308, 316, etc.), martensitic (410, and 416), ferritic (409, and 430.) and duplex (2304, 2205, 2507 etc). The groups of stainless steel most commonly welded are austenitic and duplex.

## AUSTENITIC STAINLESS STEELS

Austenitic steels have austenite as their primary phase (face centered cubic) structure. Austenite steels make up over 70% of total stainless steel production. They contain a maximum of 0.15% carbon, a minimum of 16% chromium and sufficient nickel and/or manganese to retain an austenitic structure at all temperatures from the cryogenic region to the melting point of the alloy.

## DUPLEX STAINLESS STEELS

Duplex Stainless Steels have a mixed microstructure of austenite and ferrite and have roughly twice the strength compared to austenitic stainless steels and also improved resistance to localized corrosion, particularly pitting, crevice corrosion and stress corrosion cracking. They are characterized by high chromium (19–32%) and molybdenum (up to 5%) and lower nickel contents.



## JOINING STAINLESS STEEL

When welding stainless steel it is imperative that the weld and root face are protected from the atmosphere to eliminate the creation of chromium carbides. TIG welding is the most popular process for high quality applications or root runs, prior to filling with an alternative process. TIG Consumables are available in the SifSteel Stainless range covering 308L, 309L, 310, 312, 316LSi, 347 & Duplex. MIG welding can also be used with increased speed being the main advantage. Recent technological advances in welding equipment have enable more aphetically pleasing results. MIG consumables are available in the SifMig range covering 308LSi, 309LSi, 312, 316LSi & 347. Plus flux cored wires covering 308L, 309L & 316L. MMA (Manual Metal Arc) can also be used successfully in applications or locations which make it difficult to adopt other process. MMA consumables are available in the SifChrome range covering 307, 308L, 312 & 316L. TIG or MIG brazing can be used and is especially useful if the material is required to be joined to copper or steel. The most suitable consumable in this case would be Sifphosphor Bronze No 8 or SIFMIG 8,

## GAS PROCESSES

It is possible to gas weld the common grades of stainless, but it is important to use Stainless flux and also apply the flux in paste form (mix powder with water) to the reverse side of the joint.

Stainless Steel can also be silver soldered or brazed, which is again a benefit for dissimilar metal applications. To silver solder stainless, a high silver content alloy is required (such as SIF Silver Solder No 43 55% Ag Cd free) and a suitable flux (SIF Flux Silver Solder). Alternatively, a 'nickel bronze' brazing rod such as Sifbronze No 2 together with 'Tool Tipping/Brazing Stainless' flux (note: do NOT use Stainless flux as it is for gas welding of stainless)

## PROCESS TIPS

Cleanliness of the workpiece is most important. Only use stainless wire brushes for cleaning. Avoid striking the arc outside the joint, as this can lead to pitting and cracks. With TIG, use a thoriated tungsten and do not allow it to contact the workpiece, which can lead to contamination. After welding, clean thoroughly using a stainless brush. Use SIF Pickling Paste to clean discoloration from surface and restore chrome oxide layer on the stainless. The weld can become contaminated and 'rust' spots appear on the stainless if ferrous particles have inadvertently been allowed to enter the weld area. This can be caused by poor housekeeping (stainless brush being used on steel) or other operations in the welding area which produce air borne metal particles, such as grinding. ●

# sif tips



Technical advice in the original SifTips style was started in 1932. 'Sifbronzing' is an almost universally recognised way of describing the low temperature bronze welding of sheet steel, cast iron and other metals. This explains why Sifbronze, the company which first developed and promoted the technique, is generally considered to be a supplier of high quality welding rods, wires, fluxes and equipment.

'Will the Welder' was a SifTips magazine that was produced in the early 1930s. The aim was to provide users with ideas and tips on how to get the most out of their welding equipment.

Sif is renowned for its UK manufacturing heritage as well as its complete range of quality welding consumables used globally for almost a century.

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