



Working with Stainless Steel

Introduction

The purpose of this Information Sheet is to highlight good practice when working with stainless steels.

Know the Material

Understand in what important aspects the properties of stainless steels and carbon steels differ and how these affect fabrication behaviour. Literature is readily available from stainless steel producers, libraries and journals. Materials are covered in various British Standard specifications and all these sources should be approached to gather information.

Select the Correct Grade of Stainless Steel for the Job

Stainless steels are selected primarily for corrosion resistance and/or cosmetic appearance. Always ensure that service environments are defined, and consider the benefits in service of good design, fabrication and finishing.

Design every Fabrication with Care

Always design using smooth contours and radiused corners such that fabrication and in-service cleaning can be effected. Avoid crevices and dirt traps. Also avoid sharp changes in section and other stress raisers. Special consideration must be given to eliminating crevices such as open lap joints and cavities between bolted members. In service, guard against concentrations of chemicals lodging in any one zone.

The Importance of Surface Finish

To give maximum performance in service, all fabrications need to be made in the correct grade of material and need to be correctly finished. A smooth uniform surface always looks good and invariably provides the best service life by eliminating ledges and crevices. Each fabrication must be considered in the light of the facilities in the workshop. Pre-finished and plastic coated sheet/plate is readily available, the plastic film affording protection throughout manufacture. Additionally overall polishing, blasting or other treatment provides an alternative finishing method. Never underestimate the importance of in-production damage with the added cost of remedial work.

Apply Good Housekeeping

Stainless steel can be contaminated by pick-up of carbon steel. The ideal is to have workshops and machinery dedicated to stainless steel work, but in a multi-disciplined unit take care to avoid pick-up from: -

- *Tooling used with other metals*
- *Grinding wheels etc*
- *Steel storage racks*
- *Contamination by grinding 'sparks' from adjacent steel fabrication*
- *Handling equipment*

Material Identification

Most stainless steels look the same and therefore the various grades must be identified accurately at all times. A magnet will indicate whether the material is ferritic or austenitic but within these two broad categories mixing is all too easy. A good system of identification for each grade or material is the first requirement. This can be backed up, as necessary with cast number and maker source thus giving access to Steelmakers' Certificates. Quality Assurance demands that identify be carried through all processes to finished product with useable offcuts returned to stock bearing parent identity.

Plan a Production Route

Study the job, review your facilities, and sketch out a production route. Check if machines of the required size and power are available to produce the shapes involved. Subcontracting for some parts could be necessary and cost effective. Establish that the necessary welding processes, suitable for stainless are available. Can tooling be dedicated to the stainless work to avoid pick-up/contamination problems?

Remember that austenitic stainless steels: -

- *Require increased machine tool power*
- *Show more springback than other metals making over-bending necessary*
- *Work harden more than carbon steels thus making re-working more difficult*

Buy Steel Efficiently

When you reach the buying decision, do it with thought. In case of flat products, decide if coil, sheet or blanks would suit your production best. Specify steel type accurately, decide on surface finish, protective coating and any special requirements.

Share Your Knowledge

Before production starts, share all knowledge about the steel, production requirements, good housekeeping and every relevant aspect of the work with supervising and production colleagues

ADDITIONAL USEFUL FACTS ABOUT STAINLESS STEELS

Thermal Conductivity

Austenitic steels conduct heat more slowly than other steels. At welds or other source of heating, anticipate localised heat colouring and distortion

Expansion Coefficient

Austenitic steels have 1.5 x the thermal expansion of ferritic steels. Put low conductivity and high expansion together and it is clear that there is need to take steps to dissipate heat by copper backing bars or heat sinks with heavy jiggling to control distortion

Welding Oxide/Heat Treatment Scale

Stainless steels – high temperature oxides are iron rich and in normal atmospheres can be converted to unsightly rust. All such oxides should be removed prior to service.

Galling/Pick-up-Seizing

Stainless steels rely, for their corrosion resistance, on a very thin passive (oxide) film. If the film is damaged in rubbing contact the underlying active surfaces may 'weld' together. This accounts for seizing of threaded components in stainless steels and for pick-up in roll forming, pressing and other areas where contact under load is involved. Lubricants, surface coatings and self-lubricating tool materials are possible solutions.

Key considerations in working Stainless Steels

- Know the material – Knowledge improves decision making, avoids problems and saves costs
- Know the grade of material – Correct material selection is vital – risk taking is costly
- Know the design – Good design ensures savings for fabricator and user
- Know surface finishes – Good finishes perform well, look good and promote sales
- Apply good housekeeping – Good housekeeping saves rectification costs
- Apply accurate identification – Lost identity can prove costly
- Apply production planning- Planning saves costs and promotes quality
- Apply knowledge – Remember that additional information is always available from the BSSA

Before commencing any task ensure that you have received the appropriate health and safety literature from the supplier and fully understand it. If in doubt seek advice.

This Information Sheet is an update of BSSA Information Sheet No.3