



The Welding of Stainless Steels – Defining the Skills Agenda

1. *Introduction*

Thank you for your kind introduction and for inviting me to speak this evening. I was pleased to read that the Welding & Joining Society is open to everyone with a practical, technical or business interest in welding, joining and the allied technologies. My knowledge of the practical aspects of welding is limited; but I do have a strong business interest in the subject.

The British Stainless Steel Association exists to promote and develop the use of stainless steel on behalf of its member companies. We define “use” in this context as the conversion here in the U.K. of basic stainless steel products into further processed or finished goods. To meet this objective, we try to encourage the use of stainless steel by demonstrating its benefits both in existing and new applications. And to do this effectively we have an interest in the provision of specialised technical advice and in ensuring that companies are equipped with the necessary skills. In both these aspects, welding is of primary importance: hence my interest in our subject this evening.

I am conscious that stainless steel is just one of many materials that require welding and joining. You might therefore legitimately question whether my scope is too narrow for this evening’s programme. However, there are a number of reasons why I believe that focusing on stainless steel can help us identify and define a broader skills agenda:

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- a. Firstly, it is experiencing rapid growth. The average rate of growth of stainless steel globally over the past 20 years has been 5/6% p.a., twice the average of other advanced metals such as aluminium and significantly higher than ordinary steels. Approximately one third is used in the domestic applications with which we are familiar. Two thirds is used in industrial applications, including process plant, construction and transport.
- b. Secondly, apparent consumption is closely correlated with successful advanced manufacturing economies. European apparent consumption has been at or above the global average, with the market leaders, Italy and Germany, and more recently Spain, achieving rates of growth well above these levels
- c. Thirdly, and this provides the national context for this evening's agenda, the U.K. has experienced rates of growth at half or less than half the European average

To this extent, stainless steel is a microcosm of the ability of the UK economy to compete effectively across a range of industrial sectors.

2. *The Stainless Steel Skills Research Project*

There are a number of explanations for this poor relative performance. However, I want to focus in this context on one potential factor, that of fabrication skills, and in particular welding skills. In doing so, I hope that I can open up the platform for the speakers, who will follow.

Stainless steels, as you know, have different physical, mechanical and thermal properties to mild steel grades and require different treatment, if they are to be formed or fabricated successfully. It is a common perception that stainless steel is

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not only different, but difficult to fabricate. There is equal evidence that these differences are not always fully appreciated by designers and fabricators, leading to sub-optimal performance and appearance, and in the worst cases material failure.

This begs at least two important questions:

- a. Firstly, whether there is a sufficient pool of relevantly skilled technicians at all levels to meet both current and future demand?
- b. Secondly, whether there are adequate training resources to meet this demand?

To try to answer these questions, BSSA last year undertook a research project into the current state of fabrication skills and training with a specific focus on companies specialising in stainless steel. It was carried out by Steel Training, now MetSkill, and was supported by the DTI.

A questionnaire was sent to 270 companies, followed up by a number of face-to-face interviews. 37 questionnaires were completed in all, the majority from SME's. 45% of these could be classed as fabricators and 21% as sheet metal workers, so the sample could be regarded as reasonably representative. 81% of companies reported that stainless steel represented 50% of their activity or more. This feedback was supplemented by visits and discussions with FE colleges, training providers, Standards and Assessment bodies, suppliers of consumables and the Stainless Steel Advisory Service.

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The results were interesting, especially in regard to welding.

- Welding and cutting were the two most quoted skills, amounting to 34% and 33% respectively of those quoted
- The types of welding, in which welders were classed as competent, were ranked MIG, followed by TIG and then MMA. These three accounted for 73% of the total
- The age of welding equipment listed 64 items as less than 5 years old, 53 items between 5 and 15 years old and 5 items over 15 years old

How far did this meet industry needs?

- 15 companies, 40% of the total, reported skill gaps, of which the overwhelming proportion related to welding
- Particular concern was expressed that welders do not have sufficient understanding of why and how the process should be carried out, particularly where more demanding specifications and materials are concerned

Apart from these concerns, there was a deeper, underlying problem, which needed to be addressed:

- Larger companies were continuing to diversify expertise in the course of slimming and de-layering exercises
- Only very limited recruitment of apprentices is taking place into engineering generally, and into welding particularly
- At HNC, HND and degree level, there is a worrying trend in the reduction of students applying for engineering and metallurgical courses

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- For many companies, skills acquisition and retention is therefore a matter of recruiting from a diminishing pool of term-served engineers and welders
- Companies are therefore relying less on sending employees on external training courses, but are relying more on “topping up” the required skills in-house, when required

Against this background, what sources of training are available?

Colleges continue to provide programmes for the basic training of engineering apprentices, including welders. However, there is declining demand and this, combined with commercial pressures, is reducing the number of colleges both willing and able to provide training in more advanced materials such as stainless steel. I add the word “able”, because a member of staff of one college, which continues to provide a welding course, told me that his students have to be given exemptions from the practical examination in stainless steel welding, because the college cannot afford to provide samples for the students to weld

Universities continue to provide higher academic qualifications, but the declining numbers of students applying for courses in engineering and metallurgy is widely recorded. It is also, by all accounts, increasingly difficult for lecturers to provide more than a very general introduction to basic materials. Stainless steels appears to face a particularly difficult hurdle, as it is not regarded as a separate material, like aluminium, for example, but as a niche steel – interesting, but esoteric!

The most frequent source of company training is a competent colleague within the organisation, representing 35% of the sources mentioned, compared with 22% for colleges and universities. Qualified instructors were mentioned in only 12% of cases, the remainder representing the time-honoured approach of ‘learning from Nellie’, in other words from someone who may or may not be proficient, and who may or may not be capable of developing skills in someone else

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This might represent a highly discouraging picture, were it not for the role played by institutes and associations, and by equipment and consumables suppliers, for whom on-the-job training is an integral component of their marketing. In this regard, welding is well served by TWI on the one hand, and by a range of equipment and consumables suppliers on the other. Between them equipment manufacturers and other suppliers accounted for 33% of in-house company training, significantly more than colleges and universities and almost the same as competent colleagues.

In this context, it is worth commenting on accreditation. For welders, accreditation is widely recognised as EN 287 and 288, the American ASME 9, and the older, but still widely used, coding system. However, there was a concern expressed that the knowledge test in EN 287, which is not mandatory, is not widely used; and that this represents a significant weakness, especially in regard to the more specialised materials, such as stainless steel. NVQ's on the other hand, are not widely used.

3. *Defining the Skills Agenda*

What conclusions may we draw from this research, to assist us in trying to define the skills agenda?

Firstly, the evidence suggests that stainless steel is broadly representative of the wider picture with regard to both fabrication and welding skills. There is an increasing reliance on a declining pool of existing experience and expertise, which is not being replaced at an adequate rate to meet future demand.

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Secondly, this problem is not unique to the U.K. A recent paper by WEM and ORGALIME, the employers' and trade union bodies representing European metal trades, states that:

If lack of skills has been highlighted as a problem for the IT sector for some time, there is a large and growing shortage in most European countries of high calibre apprentices, qualified workers, skilled technicians and engineers throughout our industry ¹

Thirdly, however, it is clear that U.K. is experiencing particular difficulties in attracting and retaining the engineering skills it requires to maintain its position as a globally competitive manufacturing economy. An *Assessment of Skills Needs in Engineering*, carried out by EMTA last year, showed that in the metalforming, welding and related trades, 88% of vacancies in construction, 75% in engineering occupations other than electrical, and 60% in other manufacturing were proving hard to fill.

Underlying the problem is the difficulty of attracting young people to a career in engineering and to take up training in related skills. The Foresight Materials Panel, which addressed this issue, states:

The balance of trade in manufactured goods is adverse and the supply of young people choosing careers in this sector is declining, leading to serious concern about the future vitality of UK manufacturing. There is a major requirement to boost the supply of skilled, creative and entrepreneurially minded people into this area, to develop new, high-quality products for domestic and export markets ²

Surveys show that the image of engineering among the young is poor, a perception which needs to be reversed.

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Finally, the lack of uptake and consequent commercial pressures to devote resources to other areas of education, is putting pressure on educational establishments at all levels, encouraging a cycle of declining provision. At the same time, companies are relying more heavily on in-house training, compounding the problem. The fundamental question is how we break this cycle.

In the specific context of stainless steel, the following conclusions may be drawn:

- a. We need wider recognition of the increasing significance of stainless steel and to ensure that skills are sufficient to meet growing demand
- b. The achievement of this objective would be facilitated by the creation of a network of interested parties, willing to co-ordinate their efforts to meet this challenge. This would include bodies such as TWI, those colleges and universities, which retain a centre of excellence in this field, the relevant NTO/Sector Skills Councils, such as Metskill and EMTA, and equipment and consumables suppliers. BSSA can perhaps provide the role of catalyst and co-ordinator
- c. We need to influence those who establish curricula and set standards of accreditation, to ensure that stainless steel is adequately covered. The door is open. At a recent forum to discuss the Draft NVQ Level 4 in Welding Engineering, under development by EMTA, the Metskill representative, supported by TWI, was able to table a simple amendment identifying stainless steel as a material requiring detailed knowledge in its own right, rather than including it generically under high alloy steels or a nickel alloys, which was readily accepted.
- d. We need to put in place a programme to support training providers with suitable material, in both senses of the word. The launch of the Stainless Steel Specialist Course is one small step in this direction. The provision of samples of stainless steel to colleges, to enable their students to practice their welding, might be another.

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- e. Lastly, those of us in the industry need to encourage initiatives to make engineering, and specifically welding, an attractive vocation to the younger generation. The support of skills competitions, such as SkillWELD, fall into this category, as well as the work of organisations such as The Campaign to Promote Engineering.

No one party can attend to all these issues, but together we can try to meet the challenge of defining a skills agenda, which not only identifies the gaps in current provision, but is capable of reversing recent trends.

¹ Skills Shortages in the Engineering Industry, WEM and ORGALIME Position Paper, Brussels, August 2001

² Engineering Education for Wealth Creation, Foresight Materials Panel, December 2001

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