



UK welding standards must improve

The authors of this article who have a combined 90-years of experience as welding engineers argue that welding engineering, in all its aspects, has fast become a forgotten and disrespected science and technology, to the detriment of the performance of welded structures produced by the United Kingdom welding fabrication industry resulting in a potential danger to health and safety. By **D W Holden*** and **E J France****

TO justify what needs to be done to improve the welding skills of the UK welding workforce, let us answer a possible question that could be put to people in general and yes maybe to politicians.

Question: What skills are more important to the UK economy, 'computing' or 'welding'?

Answer: It all depends on how you look at the question. Most people would answer that it is computing. However, the reality is that it is, in fact, welding. The reason why welding is so important is that computing is entirely dependent and reliant upon a constant supply of electricity. Constant electricity supply is dependent upon the welds that hold the generation

plant together being of appropriate quality, such that there is no loss of power due to premature equipment failure. If we allow welding to become a 'forgotten technology' and the welders produce inadequate weld quality in power plant, then power cuts resulting from poor weld quality will become more frequent and exceed any back up battery supply, and then there will be 'no computing'. Therefore, welding is a more fundamental requirement than computing. Establishing this fact underlines an urgent need to enhance the skills of welders.

Question: Where are the next generation of welders to come from and how are they to be educated and trained?

Apprenticeships in industry

Current apprenticeships in the welding industry are seriously flawed. This comment must be taken as fact if progress is to be made in training welders. The welding fabrication industry is vast, it includes many welding processes, materials, specifications and standards, and, therefore, the numbers of new skilled welders required is considerable.

Some companies train apprentices, mostly leaving it to the older welders within their company to pass on skills, but such training will only involve welding techniques, materials and standards that are applicable to that company. If the product of the company is, say, garden gates, this feature would determine the

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Fig 1. Illustration of automation of welding processes using a welding robot

level of training. Alternatively, should the product be nuclear pipe work, then again this would influence the training level. This is a serious drawback for the welding industry as it produces variable levels of skill from company to company and confusion for the welders.

Another aspect of irresponsibility in welding, within many companies, is the attitude of management to training. This attitude is of a disparaging nature, with comments such as: 'just watch what he does over there'. Welding to management is regarded as simply a means to an end, rather like painting or wiring a plug, it is not important, anybody can do it!

One hopes that any reader of this article appreciates how dangerous this attitude is, especially in relation to aspects of health and safety when welded fabrications are put into service. Everyone should be worried by this reality.

Part or full time study

Some companies allow day release, the co-author of this article, D W Holden, has taught in colleges that are involved in this activity and has witnessed the standards that can and cannot be attained.

The City and Guilds Institute courses have stood the test of time by way of basic theoretical knowledge, but the practical welding skill level falls short of what industry requires. Despite this, the philosophy of these courses are sound, all that is required is enrichment. The current

reality is a very basic level of practical skill is taught, with a limited number of welding processes, due to restricted amounts of material being available. There are other courses available, for example, evening classes providing, typically, a 12-week short course. The authors have personally witnessed welders who, after being trained for 12 weeks, were subsequently dismissed for their poor skill levels shown in industry. Whoever designed these short courses have no understanding of the most complex of journeyman professions and should be severely criticized, such courses are a waste of time and government money. Health and safety rules are now very strict, welded

structures are everywhere, peoples' lives are at stake on oil rigs, chemical plants, pressure vessels and nuclear installations etc, and we train welders on a 12-week course! This is an unacceptable state of affairs, as well as dangerous and absurd.

On-the-job training

Training 'on-the-job' is one of the worst methods of training apprentices adopted by welding fabrication companies. It is a technique that breeds bad working practices, welders passing on their own unverified methods they have used for many years. Some of these welding methods may be good, but generally they are bad – with short cuts predominant. In companies, welders who are training apprentices can be subjected to time restraints derived from production demands, this leaves less time for on-the-job training and leads to low skill attainment and confusion.

In the welding industry, young people and apprentices hear about 'coded welding', with its high skill requirements, they then ask but what is it?

Very few, if any colleges, train apprentices with a view to becoming a 'coded welder'.

How does one obtain this coded level of welding ability? Welders need to be trained to recognize they have to achieve the 'common objective' in a welded joint¹. The training required can be implemented by enriching the welder training courses based upon the City and Guilds philosophy, which should be government sponsored and supported.

At this point we can now accurately define what is a truly skilled welder:-



'A welder is a person who has developed the ability to implement those techniques which are known to suppress and control imperfection levels that can occur in a weld, when any welding process is applied to a joint, in accordance with an approved and/or qualified welding procedure or instruction'².

The importance of the person

Over recent years in the welding fabrication industry, misguided management have tried to resolve the lack of skills by thinking that they can replace welders with automated welding machines (Fig 1).

Now we briefly explore the effects of the automation of welding processes.

• **Question:** Does robotic automation in the application of welding a joint produce welds faster than a manual techniques?

True answer: No – but, yes, if one is prepared to accept and tolerate a level of imperfection and defectiveness in the finished welded joint.

• **Question:** Does a welding robot actually carry out welding?

True answer: No. This is a fact as indicated below!

• **Question:** Does a welding robot need a skilled welder to operate it?

True answer: Yes, most definitely.

• **Question:** What advantage over manual welding techniques and application of welding processes does a welding robot provide?

True answer: Consistency of weld quality only. The correct use of welding robots in industry provides an insight into the importance of, and requirement for, skilled welders. This will be a surprise to the uninitiated and why the UK economy still desperately needs more skilled welders, as the truth indicates that automation does not directly replace welders in reality. Automation of a welding processes actually makes the individual welder more productive; it cannot replace the welder.

When a skilled welder is in the weld joint development mode, the result is derived by trial and error, ie an empirical approach. The applicable weld procedure to make the joints for a fabrication, such as the need for high integrity fabrication as illustrated in Fig 2, is the MIG welding process. What is

needed to fulfil this function is considerable practical welder skill, experience and individual ability. This is an illustration of why it is vital welders need and receive the initial and appropriate training to satisfy the needs of the welding fabrication industry.

The professional welding engineer

Welding engineers come mainly from an academic background with a university degree, usually in materials science or nowadays a welding degree. Some organisations regard this as the only qualification necessary to be given the title of 'European Welding Engineer'. This way of thinking should be challenged as the duties of a welding engineer go far beyond materials and how they react when welded together. All degree educated welding engineers have to realise that to be regarded as a professional they must obtain many years of practical and industrial experience.

Questions to be answered in production

There follows six examples of practical knowledge required, although there are many more inevitably.

• Which welding process will give the quality of product with an economic speed of manufacture?

• What is the operator skill level within the company?

• Which are the welding specifications to comply with to maintain a standard for quality?

• How do we train our welding operators to reach these standards?

• Which welding sequence must be adopted to control weld distortion?

• What are the welding parameters and process manipulation techniques to produce a satisfactory weld procedure?

A few companies may employ a person whose role as welding development engineer would be to have the practical skills to develop and select the following:

• The appropriate welding processes and welding parameters for the joints,

• The manufacturing techniques,

• To train and test welding operators and to provide welding engineers with welding parameters to generate procedures.

To establish good and effective welding parameters by means of development



Fig 2. Developing manual welding on a prototype austenitic stainless steel container for spent nuclear fuel container. Pic courtesy D Holden

involves years of practical experience and a good theoretical knowledge. Many companies today may operate with just a welding engineer in total control, some with no welding engineering input at all, and some leave the welding at the total discretion of the welders. This is where the problems begin.

A few examples of burgeoning problems witnessed during the authors' long careers are mentioned here, some of which could bring about a catastrophic failure:

- Welding engineers obtaining weld parameters from books, or asking the welder or the foreman or even guessing – the latter being the most dangerous action to take. Welding is an empirical science which means development of procedure is mandatory.

- **Question:** Where is your company welding engineer? Response: "I am not a welding engineer, just a planning engineer, I get the weld parameters from the welders". A true quote from a weld audit of a crane manufacturer, this remark should frighten every one and indicates aspects of the decline of welding fabrication. The engineering virus was deeply engrained in this company.

- **Question to welder** – Where do you get the parameters for welding that joint?

Answer – "My work mate tells me what to use". This could lead to a mistake that produces a very defective welded joint that prematurely fails in service and gives rise to injury or even a fatality.

- What is a weld procedure for? "We don't use procedures, we leave it to the welder". A quote frequently to be heard in welding fabrication companies these days. Readers of this article should be really worried by this behaviour by management in the welding fabrication industry today.

It is accepted that some knowledge of metallurgy/materials science is indeed necessary for consideration to be given the title of a skilled welder or indeed a 'welding engineer'. However, without some practical experience and its potential contribution to an individual's knowledge base, one would fall well short of requirements and be open to severe criticism. These comments should form part of the enrichment of welding training courses given in educational establishments.

Question: Do welding apprentices



and student welding engineers receive the appropriate training in all aspects of welding engineering?

True answer: No, therefore this situation needs to be remedied and quickly.

Conclusions

- More government money is needed for companies to give day release to trainees.
- Welding courses need to adapt and adopt the techniques required to increase the skill level to satisfy industry. Short courses in welding should be scrapped immediately.
- Colleges should undertake a greater range of courses for advanced coded welding, after basic training to City and Guilds level.
- College tutors and/or instructors should be subjected to training in current welding practice through periods in industry to advance their knowledge, where they require it.
- A better appreciation of welding by management is needed.
- The attitude to welding engineering by management that 'just anyone can do it' must be consigned to the rubbish bin, otherwise welding fabrication will fall into disrepute and the decline will continue.
- Management need to be reminded that 'welding' is not just about pressing a button and the joint being held together, this is not an acceptable criteria for a welded structure, no matter what the

service duty of it is.

- There is a need to change people's attitudes towards welding before management find themselves facing a judge in court for bad welding practice, if and when somebody has been injured or killed, due to premature failure of welds on a structure.
- It should be an accepted fact that there is no shortcut to successful practical application of welding processes with a high level of proficiency.

To illustrate an important industrial point, if for example we are to have a UK-based steel industry in the future, then we need the next generation of the metallurgical and welding workforce in all its aspects to be forthcoming. A considerable amount of the steel produced in the future, in all its product forms, will inevitably be required to be weld fabricated. The question here is, by whom, and where will they be welded? This is especially relevant when we observe the decline in respect of welding engineering and technology in the UK. ■

References

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