

Trends in Welding Qualification, Training and Certification

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Abstract

Welding is one of the oldest and most popular methods of joining materials. Over the years it has developed many folds in terms of technology because of which its use has spread to a number of critical applications in industries. This has led to an increased demand for appropriately qualified, trained and certified personnel to handle all welding related functions in industries. Today number of options are available in the welding field to get qualified, trained and certified. Though they were available earlier also, welding personnel as well as industries were not giving due attention. But with the increasing quality requirements both in terms of stringency and consistency, the benefits of having qualified, trained and certified personnel are being realised and many industries insist on recruiting and entrusting responsibilities to them only as far as possible. This paper highlights the present status, and future trends in these three areas, with particular reference to India.

Key Words: Welding-Qualification-Training-Certification-Education

1.0 Introduction

Welding has become the most preferred method of joining materials and is being used for a number of applications in a variety of industries. This is amply brought out by the DVS (German Welding Institute) slogan 'nothing is possible without welding'. A primitive method of heating two pieces of metal and hammering them to make a joint (what we now call as forge welding) has now evolved as a scientific technique, method for joining not only metals but many materials for critical applications in industries. Today many materials can be joined meeting stringent quality requirements using appropriate welding techniques. The vast developments in this field and their extensive use for critical applications in industries has necessitated the employment of appropriately qualified, trained and certified personnel for handling various welding related functions. The demand for such competent welding personnel is steadily growing because the industries are taking up critical, challenging jobs in which the main 'mantra' is 'consistent quality first time everytime' and there is no opportunity for experimentation. With the increasing attention not only to quality, but also to productivity, reliability

and safety in all industries, it is but natural for all of them to look for suitably qualified, trained and certified personnel to manage these functions. Thus an ever increasing number of programs are available today for qualifying, training and certifying welding personnel at various levels. This paper attempts to highlight the present status and the emerging trends in welding qualifications, training and certifications arena.

2.0 Need for Qualification, Training and Certification

Today many components in industries are welded and their successful service performance depends to a large extent on the quality of the welds. With the industry resorting to the use of many special materials to suit the service conditions together with special consumables, techniques and equipment to weld them, it becomes necessary that a knowledgeable work force handles these activities. In the past most of the welding related activities were handled by persons whose competence was a question mark. Most of their activities, learnings and experiences were on a trial

and error basis. But in the present day scenario, there is little opportunity for such type of functioning and many customers insist the employment of a suitably qualified, trained and certified person to handle relevant functions in welding. Even the codes stipulate the use of appropriate welding personnel to coordinate and to take care of welding related functions. ISO 3834 (Quality requirements for welding-Fusion welding of metallic materials) and EN ISO 14731 (Welding Coordination-Tasks and Responsibilities) are examples of this. According to an article by Quintino et.al (Ref 3),

'whenever a manufacturer refers to compliance with a certain ISO 3834 quality level it should be sufficient to demonstrate the manufacturer's capabilities are fully adequate for control of welding activities in relation to the type of product or welding work that is being carried out by the company'

It is relevant to point out here (Ref 4) that 'EN ISO 9001-2000 considers welding a "special process" meaning that it must be taken in to consideration much before the weld is performed'

Today even industry specific training, certifications are available to ensure that the welding personnel possess the correct skill and knowledge to perform their functions properly and safely to achieve the desired results. So the olden day trend of assigning the welding functions to 'someone' who knew 'something' in welding is fast diminishing and the industry has realised the benefits of qualified, trained, skilled and certified competent welding personnel.

Welding is employed in a variety of industries for many applications and so the knowledge, expertise, training requirements vary from one industry to another. **Table 1** summarises the various qualifications and the certifications in welding and their usefulness in various industries.

3.0 Qualifications Training and Certifications

Of these three terminologies, training needs no elaboration. But however the terms qualification and certification need some elaboration. **Table 2 (Ref 1)** brings out the differences between these two terms. According to D McKeown et.al (**Ref 2**),

'Certification means that the person has been assessed in some manner and found to meet specific criteria by an authorised body'

'Certificates are subject to review and periodic renewal and if the applicant can no longer show competence or a relevant job function, they may be cancelled'

'The difference may be summarised as that difference between qualification and experience'

Certification is usually confined to narrow range of activities but a qualification tends to be more of a general nature and

lifelong without any shelf life. Both have their importance, usefulness and recognition in appropriate places.

4.0 Qualifications in Welding-present Status and Future Trends

A number of formal qualifications are available in India in welding. These range from the basic ITI qualification to the post graduate qualifications. **Table 3** gives more details on these. It can be observed from this table that apart from the programs offered by the regular educational institutions, professional institutes like Indian institute of welding and the International Institute of Welding are also offering programs for the benefit of working professional to enhance their qualifications and move ahead in their career. The AMI IW program of IIW-India is considered as an equivalent to an under-graduate degree in welding and the successful completion of the same makes the candidate eligible for post graduate courses. The diploma programs of IIW qualify the welding personnel at different levels and are well recognised throughout the world and offer a uniform qualification to all welding personnel. Both the programs consist of theory and practical portions which helps the candidate to gain adequate knowledge not only in theory but also for applying the same in practical situations.

The qualifications scheme of IIW can be closely linked to the requirements of ISO 3834 which stipulates that all the welding activities shall be coordinated by a 'welding coordinator-WC' as per ISO 14731-2019. Though the specification does not clearly spell out that WC shall be an IWS or IWT or IWE, it can easily visualised from the specification. It is a usual practice (may not be followed by all industries) to have an IWS for ISO 3834-4 accreditation, an IWT for ISO 3834-3 accreditation and an IWE for ISO 3834-2 accreditation.

By qualification most of the time we refer to the formal academic qualifications. This qualification decides the entry point for a welding career. **Table 4** shows the details of various qualifications and the entry point they provide for a career in welding. It is relevant to point out here that welding is a multi-disciplinary career and requires technical personnel from various engineering fields. **Table 5** brings out this fact by highlighting the usefulness of qualifications in different engineering branches in different type of jobs in the welding field.

The trends and the future in welding qualifications can be summarised as follows

- More number of employed, experienced welding personnel will tend to qualify themselves through programs like IIW Diploma.
- Industries will tend to give preference to candidates who possess welding specific qualifications (application based)

like post-graduation, diploma in welding etc. to monitor welding activities.

- Fresh engineers will find that their under graduation is not sufficiently recognised for handling welding related activities in industries and therefore will pursue further studies to enhance their welding qualifications.
- Leading industrial houses, research bodies may offer specialised, industry specific qualifications in welding or associate themselves with other institutions to offer such programs.
- Welders, possessing adequate practical skills may have to acquire new skills with changing process technology, automation, machine learning and acquire higher educational qualifications / skills to enable them to competently handle higher responsibilities and a mere number of years of experience may not be sufficient.
- While the variety of qualifications and the number of formal educational institutions offering formal educational qualifications in welding may not increase, the demand for and the number of institutions offering off-campus programs, online programs, evening programs, part-time programs for practicing personnel will increase multi-fold.
- More codes and standards with specifications will tend to specify the requirement of qualified welding personnel, especially for critical service requirements and hazard potential and consequential damage especially to life at large.

5.0 Training in Welding-present Status & Future Trends

Practical and skill related training assumes lot of importance in many fields and welding is no exception. In fact more than formal qualifications, the demand for practical welder training is enormous. Numerous studies, surveys point out the huge demand for trained, skilled welders and many industries are always on the lookout for good welders. **Table 6** shows the entry points in welder training and the career route one can take after training. In India particularly this welder training has lot of importance since a large percentage of welding is still done by manual metal arc welding. Presently a number of institutions offer this training and **Table 7** shows the various agencies, participating institutions and their programs, schemes. This should bring out clearly the variety of options available for and individual to acquire the relevant skills in welding. While the formal training institutes offer the basic program which are not totally in tune with the industry requirements, there are many other programs from other institutes which are meant to make the welders 'industry ready'. Apart from these institutes, leading industries also run their own programs which train and upgrade the skill of welders to suit their specific job requirements.

The training programs at welder levels are very much in demand but there are hardly any programs at higher levels viz. supervisory and engineer levels. Probably it is felt that these levels don't demand practical skills on a day today basis. However, the diploma programs of IIW ensures that the practical skills are imparted not only at the welder level but also at higher levels like specialist, technologist and engineer. The successful welding personnel of these programs understand both theoretical and practical aspects better and can apply their knowledge usefully in their jobs.

The GOI is also laying immense importance for skill development, particularly in welding. Many steps have been initiated to develop the skilled welders who are always in short supply. National level skill competitions are also being organised by institutions like IIW-India to encourage skill development.

The trends and the future in welding training can be summarised as follows.

- ♦ Use of appropriately trained welders will increase, especially for critical jobs.
- ♦ Increasing use of advanced training methods like simulators, online training etc.
- ♦ Increased participation by all stake holders - government, industries, training institutes - in making systematic programs to enhance the skills.
- ♦ Sincere efforts to change the image of welding in peoples' minds which alone will ensure more people choosing welding as a career.
- ♦ More programs focussing on automation, robotics and machine welding will emerge along with application of AI and machine learning.

6.0 Certification - Present Status & Future Trends

The distinction between qualification and certification was highlighted earlier. Certification ensures that the persons knowledge, skills have been assessed to meet specific requirement. There are many certification programs in welding also which ensures that the person is suited for some specific activity in the industry. By employing a certified person the industry ensures that they have entrusted the responsibility to a person possessing adequate knowledge and skill. Sometimes this becomes a pre-condition also when following certain codes. **Table 8** details some of the certifications schemes related to welding. The use of appropriately certified personnel is on the increase in industries today because of many reasons some of which can be

- ♦ Proven knowledge in materials, equipment, processes, consumables and procedures

- ♦ Proven knowledge in codes, standards
- ♦ Proven knowledge in inspection methods and practices
- ♦ Proven knowledge in safe practices
- ♦ Proven knowledge in automation, productivity and economics

While the qualification ensures that the person has an overall knowledge, the certifications ensure that he possesses specific knowledge to handle the job and because of this many welding personnel opt for certification programs after their formal education and training. Today many codes insist on using certified personnel for many activities. As indicated earlier, all the certifications are to be revalidated after a period which ensures that the person continues to possess adequate knowledge, skill to perform a specific function. In some certifications, even the physical health of the person, eye sight etc. are taken in to consideration before certifying him.

The trends and future in certifications in welding can be summarised as follows

- ♦ Increasing number of specifically designed certification programs for specific activity
- ♦ Less number of general certification programs
- ♦ Increasingly tough and job skill, knowledge oriented tests
- ♦ Increasing number of codes, specifications requiring the use of certified personnel
- ♦ More training, coaching institutes to conduct these programs

7.0 Conclusion

Over the years welding qualifications, training and certifications have gained lot of importance especially because

of increased stress on quality, productivity, reliability and safety. Both industries and governing agencies like ASME, AWS, EN, ISO, etc. are laying lot of emphasis for entrusting various welding activities to qualified, certified and trained personnel. Effect of globalised supply chain require vendors in this chain to follow the customer dictated service and quality standard, code. With that increased emphasis, welding personnel are also keen on getting themselves appropriately qualified, certified and trained. The future has lot in store in these areas of welding which will enable the industries to take up challenging jobs.

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Table 1 : Usefulness of some qualification and certification in welding

Type	Examples	Useful for
Qualification	DME, AMIIW, BE, M.Tech etc.	<ul style="list-style-type: none"> • General supervisory, managerial jobs in welding • Research and development • Teaching • Marketing • Consultancy
	IWE (Post graduate Diploma level program) IWT (Post Engg Diploma Welding Diploma)	<ul style="list-style-type: none"> • Welding engineer; making procedures; • Design, development, • Can be a signatory for some coded jobs • Coordinates all welding related activities, system implementation
Certification	CWI, CWE, CSWIP etc.	<ul style="list-style-type: none"> • Welding inspector, Welding Engineer • Authorised to accept, reject • Coded jobs • Mandatory-stipulated by some codes

Table 2 : Distinction between qualification and certification

Qualification	Certification
<ul style="list-style-type: none"> • Is a historical fact • Usually refers to educational qualifications like BE, ME etc. • Has no validity period and is eternal • Usually given by a university, educational institute etc. • Indicates that the person has in general knowledge of the subject and has gone through a course curriculum, examination. 	<ul style="list-style-type: none"> • Confirmation of certain characteristics of an object, person, organisation. • Certified for competency • Usually refers to the achievement of a skill, specific knowledge etc. • Has a validity period • Has to be renewed after a specific period • Usually given after the person has gone through a course and an examination

Table 3 : Some qualifications in welding in India

Qualification	Remarks
ITI (welding trade)	Basic level for welders; entry point qualification for many industries
Diploma in engineering	Entry point qualification for trainees, supervisors; Mechanical, electrical more preferred for welding field; can be employed in manufacturing, marketing, servicing
Under-graduate	No programs in welding
AMIIW	Offered by IIW-India. A part-time and off campus program leading to National Welding Engineer Certification. Considered equivalent to a bachelor degree for PG courses.
Post-graduate, doctoral	Offered by many institutes, universities including premier institutes like IIT, NIT; suitable for pursuing a research, development, teaching careers.
IWE-IWT-IWP-IWS-IW	All these qualifications are offered as Diploma by the international institute of welding for various levels. The program consists of both theoretical and practical sessions; both fresh and experienced candidates can take this program and they have different routes; off-campus program; IWE diploma can satisfy the code requirements and can be a signatory for many operations as a welding coordinator.

Table 4 : Entry point for various qualifications

Level	Educational Qualification-Skills	Type of job for starting
Level 1	None; School dropout	Trainee welder, Tack welder
	8th Pass	-- do --
	10th pass	-- do --
	ITI	Welder; Qualified welder
Level 2	ITI +Experience; ATI	Supervisor, Foreman
Level 3	Diploma-Degree in Engineering, IWE, IWT	Engineer; Welding Engineer; Marketing Engineer for consumables and equipment, Design Engineer, Fabrication Engineer, Inspection, Quality control, Research Engineer, Teaching, Training
	P.G in Welding, Doctorate	Welding Engineer, Fabrication Engineer, Quality control, Marketing Engineer, Research Engineer, Teaching, Design Engineer, Training

Table 5 : How each engineering discipline can be useful in welding

Engineering discipline	Where it can be useful
Mechanical	Fabrication shops; Maintenance shops; Consumables marketing; Equipment marketing and servicing; Inspection and Quality control; Design; teaching, training
Electrical	Equipment design, marketing, servicing; Automation-Mechanisation-Robotic equipment design, marketing, servicing; Weld tracking equipment
Metallurgical	R & D labs; Consumable developments; Fabrication shops; Consumable marketing; teaching, training
CSE	Robotic, automated, computerised processes; manufacturing of process control-parameter measurement equipment; Quality control and testing equipment; data logging equipment; software development and programming of numerous welding applications; simulators
ECE	Development of remotely operated welding operations; development of testing and measuring equipment; simulators; data logging equipment; Safety equipment;
Mechatronic-Instrumentation	Automation-Mechanisation-Robotics-Measuring instruments;

Table 6 : Entry points in welder training

Entry point	Educational, Skill development routes
School dropout	Can join a Vocational training institute and get trained in welding trade; pure skill development; some VTIs ensure employment after training; can join industry as a trainee, tack welder etc. and grow up
8th Pass	Can join a Vocational training institute and join industry as a trainee
10th Pass	Can join a ITI and take the welding stream; join the industry as a trainee, welder, operator

Table 7 : Variety of training, skill development programs offered by various agencies

Agency	Details of schemes, programs
Programs under GOI	GOI through DGET has many training institutes like ITI, ATI, centres of excellence etc. and has many schemes like PPP mode, Modular Employable Skills (MES), Skill development initiatives through NSDC, NSDA
Training Programs of Private Sector	This group consists of consumable, equipment manufacturers, fabricators and other training institutes; they offer training in many processes, techniques and many times certify welders for very good employment opportunities.
Training Programs in Public sector companies	Major industries like BHEL (through WRI), ICF etc. have their own training centres which train welding personnel not only for their own requirements but also for the general industries.
Programs of Institutes like IIW-India, IWS	IIW-India offers programs like IW, National Welder training and Certification scheme through many private institutes.

Table 8 : Some certifications in welding

Certification	Remarks
Welder Certification	Many programs are available; usually done as per codes/standards like ASME Sec IX, AWS, ISO, IS, RDSO, IBR etc. Certification is given by the concerned authority preferably by a body who may have accreditation.
CWE	Program conducted by AWS for certifying as welding engineers; very popular;
CWI, SCWI	Program conducted by AWS for certifying welding inspectors at various levels; well accepted by industries;
CSWIP 3.0,3.1,3.2	Program conducted by TWI for certifying welding inspectors at various levels; well accepted by industries;
Welding Quality control coordinator	Program conducted by TWI for certifying a person as a welding coordinator.
Welding Examiner	Program conducted by TWI for certifying a person for approval of welder qualifications according to a code
Welding instructors, Specialist Welding instructors	Program conducted by TWI for certifying welding instructors
Welding supervisors	Program conducted by TWI for certifying welding supervisors
AWS Certification for	<ul style="list-style-type: none"> • Welder • Welding fabricator • Welding supervisor • Welding educator • Welding sales representative